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# LORAN AUTOMATIC VEHICLE MONITORING SYSTEM, PHASE I
## Volume II: Appendices

R. Stapleton
F. Chambers

Teledyne Systems Company
Northridge CA 91324

NOV 11 1977

AUGUST 1977

FINAL REPORT

DOCUMENT IS AVAILABLE TO THE U.S. PUBLIC
THROUGH THE NATIONAL TECHNICAL
INFORMATION SERVICE, SPRINGFIELD,
VIRGINIA 22161

Prepared for

U.S. DEPARTMENT OF TRANSPORTATION
URBAN MASS TRANSPORTATION ADMINISTRATION
Office of Technology Development and Deployment
Washington DC 20590

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16. Abstract

This volume presents results of the evaluation phase of a two-phase program to develop an automatic vehicle monitoring (AVM) system for the Southern California Rapid Transit District in Los Angeles, California. Tests were conducted in Philadelphia, Pennsylvania, on a LORAN-based location subsystem to evaluate system and subsystem performance on fixed route and random route vehicles. Performance characteristics measured include location accuracy, time of passage accuracy, and coverage. This report consists of two volumes. Volume I contains the test results.

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# PREFACE

This final report, submitted to the Department of Transportation under contract DOT-TSC-1238, presents the results of all tests conducted under this contract. The purpose of the program was to evaluate vehicle location technology as a preliminary step in the development of a multi-user automatic vehicle location system suitable for any transit property or other vehicle fleet operator. This contract covered test and evaluation of the vehicle location subsystem only but included a system simulation in the off-line data reduction.

Teledyne Systems Co. wishes to acknowledge the valuable assistance of Department of Transportation representative B. Blood, B. Kliem, and J. Herlihy. Teledyne personnel who were invaluable in the execution of this task were R. Stapleton, B. Breen, and J. Holdsworth.

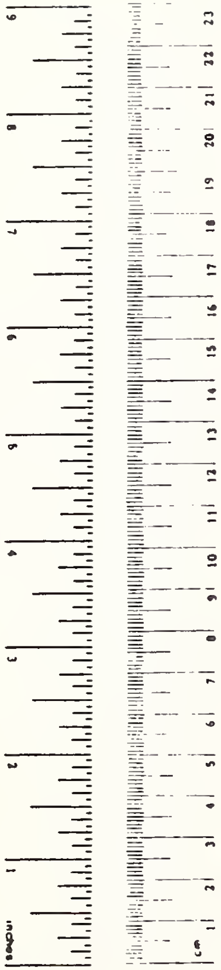
# DOT-TSC-NOTE

During the winter of 1976-77, four different techniques for automatically locating land vehicles were tested in both the low- and high-rise regions in Philadelphia, Pennsylvania. The tests were carried out by four different companies under separate contracts to the U.S. Department of Transportation, Transportation Systems Center. The tests were designed to evaluate the techniques for their applicability as location subsystems for automatic vehicle monitoring systems. This document represents one of the contractors' final report. A summary report on all systems tested is available as report no. UMTA-MA-06-0041-77-2.

# METRIC CONVERSION FACTORS

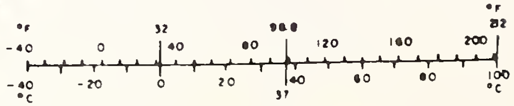
Approximate Conversions to Metric Measures

| Symbol | When You Know | Multiply by | To Find | Symbol |
|---|---|---|---|---|
| | | **LENGTH** | | |
| in | inches | 2.5 | centimeters | cm |
| ft | feet | 30 | centimeters | cm |
| yd | yards | 0.9 | meters | m |
| mi | miles | 1.6 | kilometers | km |
| | | **AREA** | | |
| $in^2$ | square inches | 6.5 | square centimeters | $cm^2$ |
| $ft^2$ | square feet | 0.09 | square meters | $m^2$ |
| $yd^2$ | square yards | 0.8 | square meters | $m^2$ |
| $mi^2$ | square miles | 2.6 | square kilometers | $km^2$ |
| | acres | 0.4 | hectares | ha |
| | | **MASS (weight)** | | |
| oz | ounces | 28 | grams | g |
| lb | pounds | 0.45 | kilograms | kg |
| | short tons (2000 lb) | 0.9 | tonnes | t |
| | | **VOLUME** | | |
| tsp | teaspoons | 5 | milliliters | ml |
| Tbsp | tablespoons | 15 | milliliters | ml |
| fl oz | fluid ounces | 30 | milliliters | ml |
| c | cups | 0.24 | liters | l |
| pt | pints | 0.47 | liters | l |
| qt | quarts | 0.95 | liters | l |
| gal | gallons | 3.8 | liters | l |
| $ft^3$ | cubic feet | 0.03 | cubic meters | $m^3$ |
| $yd^3$ | cubic yards | 0.76 | cubic meters | $m^3$ |
| | | **TEMPERATURE (exact)** | | |
| °F | Fahrenheit temperature | 5/9 (after subtracting 32) | Celsius temperature | °C |



Approximate Conversions from Metric Measures

| Symbol | When You Know | Multiply by | To Find | Symbol |
|---|---|---|---|---|
| | | **LENGTH** | | |
| mm | millimeters | 0.04 | inches | in |
| cm | centimeters | 0.4 | inches | in |
| m | meters | 3.3 | feet | ft |
| m | meters | 1.1 | yards | yd |
| km | kilometers | 0.6 | miles | mi |
| | | **AREA** | | |
| $cm^2$ | square centimeters | 0.16 | square inches | $in^2$ |
| $m^2$ | square meters | 1.2 | square yards | $yd^2$ |
| $km^2$ | square kilometers | 0.4 | square miles | $mi^2$ |
| ha | hectares (10 000 $m^2$) | 2.5 | acres | |
| | | **MASS (weight)** | | |
| g | grams | 0.035 | ounces | oz |
| kg | kilograms | 2.2 | pounds | lb |
| t | tonnes (1000 kg) | 1.1 | short tons | |
| | | **VOLUME** | | |
| ml | milliliters | 0.03 | fluid ounces | fl oz |
| l | liters | 2.1 | pints | pt |
| l | liters | 1.06 | quarts | qt |
| l | liters | 0.26 | gallons | gal |
| $m^3$ | cubic meters | 35 | cubic feet | $ft^3$ |
| $m^3$ | cubic meters | 1.3 | cubic yards | $yd^3$ |
| | | **TEMPERATURE (exact)** | | |
| °C | Celsius temperature | 9/5 (then add 32) | Fahrenheit temperature | °F |



# APPENDIX A - LORAN CALIBRATION DATA

LORAN calibration of the fixed and random route test areas was accomplished in sectors. Four sectors were defined and are shown in Figure A-1. Separate lists of calibration points by sector are provided. The list contains all points where an attempt was made to obtain calibration data. No data is included in the listing for points where a valid LORAN measurement was not possible or where the point was thrown out by the screening process.

Calibration points 600 and up are used in the special case tests only.

The calibration point lists were generated by using the software program which is shown at the end of this appendix. Also, at the end of that program, a sample execution of the program is included. The sample happens to be the calibration data reduction for the LORAN bridge special case run.

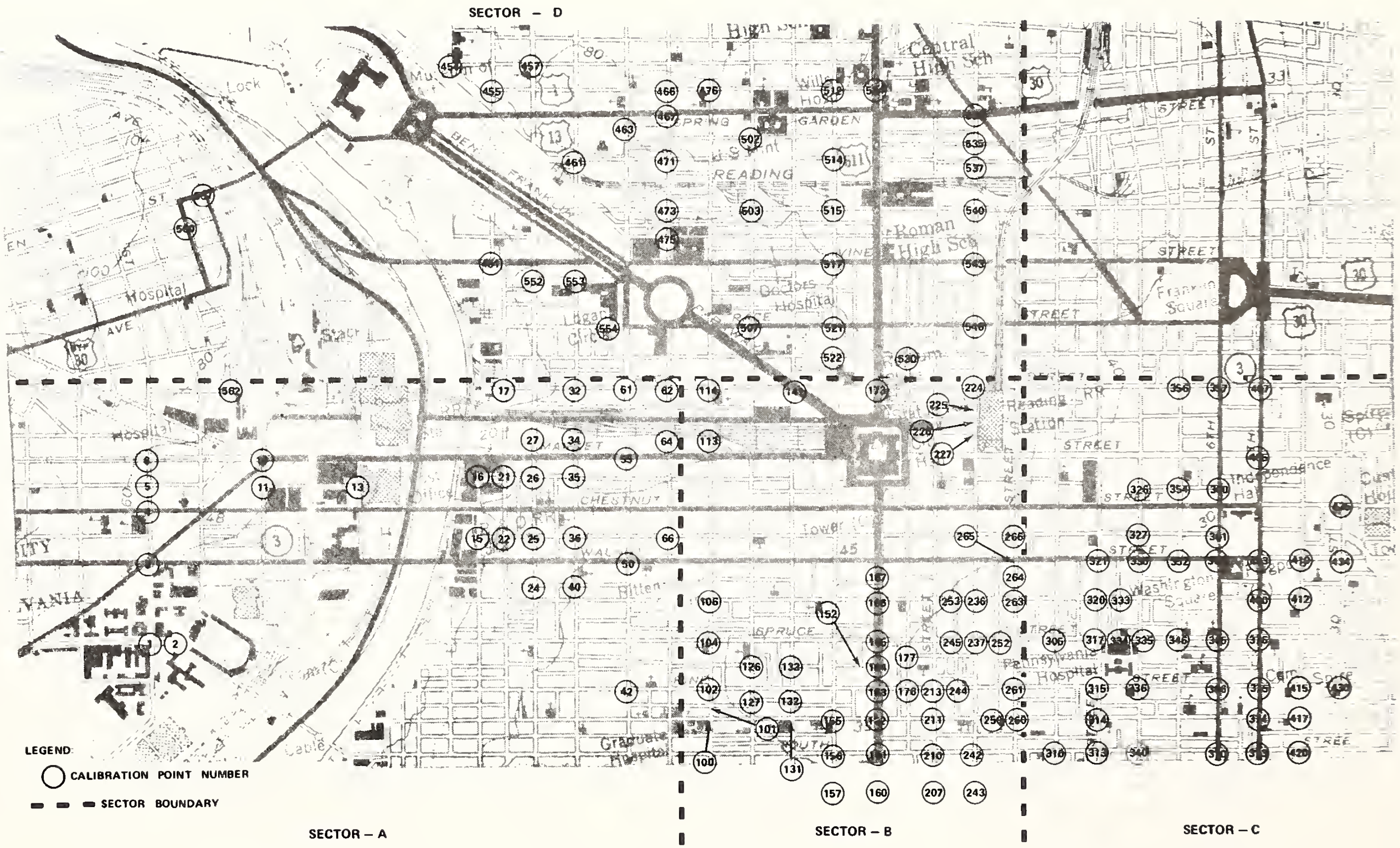


Figure A-1. Calibration Area

## A.1 CALIBRATION DATA BY SECTOR

### LORAN Calibration Data

### Sector A

| CAL Pt. No. | Intersection | X | Y | TDA Mean TD | TDA Std. Dev. | TDB Mean TD | TDB Std. Dev. |
|---|---|---|---|---|---|---|---|
| 1 | 34th St. & Spruce | 1115 | 1190 | 51,763.576 | 34ns | 82,232.300 | 93ns |
| 2 | 33rd St. & Spruce | 1340 | 1190 | 51,763.316 | 46ns | 82,232.326 | 56ns |
| 3 | 34th St. & Walnut | 1100 | 2000 | 51,762.996 | 29ns | 82,230.781 | 32ns |
| 4 | 34th St. & Chestnut | 1100 | 2610 | 51,761.582 | 21ns | 82,229.855 | 41ns |
| 5 | 34th St. & Ludlow | 1100 | 2850 | 51,761.185 | 39ns | 82,229.296 | 62ns |
| 6 | 34th St. & Market | 1100 | 3175 | 51,760.738 | 32ns | 82,228.966 | 63ns |
| 10 | 32nd & Market | 2000 | 3188 | 51,759.700 | 23ns | 82,229.453 | 62ns |
| 11 | 32nd & Ludlow | 2000 | 2922 | 51,759.757 | 47ns | 82,229.978 | 48ns |
| 13 | 30th & Ludlow | 3375 | 2875 | 51,758.910 | 41ns | 82,230.998 | 78ns |
| 15 | 24th & Sansom | 4650 | 2300 | 51,758.285 | 23ns | 82,232.573 | 44ns |
| 16 | 24th & Ludlow | 4650 | 3000 | 51,757.717 | 77ns | 82,231.791 | 140ns |
| 17 | 23rd & Arch | 4940 | 3860 | 51,755.613 | 32ns | 82,230.328 | 53ns |
| 21 | 23rd & Ludlow | 4930 | 2975 | 51,757.046 | 88ns | 82,231.203 | 114ns |
| 22 | 23rd & Sansom | 4940 | 2310 | 51,757.984 | 33ns | 82,232.789 | 74ns |
| 24 | 22nd & St. James | 5260 | 1800 | 51,758.129 | 39ns | 82,233.820 | 48ns |
| 25 | 22nd & Sansom | 5260 | 2360 | 51,757.457 | 22ns | 82,232.797 | 67ns |
| 26 | 22nd & Ludlow | 5260 | 2970 | 51,756.376 | 17ns | 82,231.762 | 86ns |
| 27 | 22nd & Commerce | 5260 | 3422 | 51,755.906 | 16ns | 82,231.097 | 47ns |
| 32 | 21st & Arch | 5725 | 3905 | 51,754.587 | 40ns | 82,230.694 | 72ns |
| 34 | 21st & Commerce | 5720 | 3422 | 51,755.434 | 23ns | 82,231.432 | 75ns |
| 35 | 21st & Ludlow | 5720 | 2945 | 51,756.246 | 29ns | 82,232.226 | 80ns |
| 36 | 21st & Sansom | 5720 | 2355 | 51,757.508 | 51ns | 82,233.233 | 91ns |
| 40 | 21st & Chancellor | 5720 | 1800 | 51,758.259 | 103ns | 82,234.210 | 89ns |
| 42 | 20th & Pine | 6260 | 690 | 51,759.015 | 67ns | 82,236.128 | 45ns |
| 50 | 20th & Walnut | 6260 | 2025 | 51,756.840 | 41ns | 82,234.014 | 95ns |
| 55 | 20th & Market | 6260 | 3240 | 51,755.117 | 65ns | 82,231.406 | 110ns |
| 61 | 20th & Arch | 6260 | 3880 | 51,753.975 | 17ns | 82,230.655 | 51ns |
| 62 | 19th & Arch | 6720 | 3940 | 51,753.605 | 84ns | 82,231.462 | 59ns |
| 64 | 19th & Commerce | 6720 | 3422 | 51,754.475 | 59ns | 82,231.844 | 80ns |
| 66 | 19th & Sansom | 6720 | 2320 | 51,756.228 | 46ns | 82,233.676 | 165ns |

Total Number of Calibration Points - 30　　Mean Radial Error 131.66 feet

LORAN Calibration Data

Sector B

| CAL Pt. No. | Intersection | X | Y | TDA Mean TD | TDA Std. Dev. | TDB Mean TD | TDB Std. Dev. |
|---|---|---|---|---|---|---|---|
| 100 | 18th St. & Lombard | 7150 | 300 | 51,758.333 | 35ns | 82,237.306 | 80ns |
| 101 | 18th St. & Addison | 7150 | 475 | 51,758.008 | 68ns | 82,237.105 | 119ns |
| 102 | 18th St. & Pine | 7150 | 640 | 51,757.351 | 80ns | 82,236.504 | 189ns |
| 104 | 18th St. & Spruce | 7150 | 1220 | 51,757.057 | 42ns | 82,236.228 | 269ns |
| 106 | 18th St. & Locust | 7150 | 1670 | 51,756.107 | 70ns | 82,235.195 | 163ns |
| 113 | 18th St. & Commerce | 7150 | 3300 | 51,753.416 | 52ns | 82,232.222 | 90ns |
| 114 | 18th St. & Arch | 7150 | 3945 | 51,752.513 | 60ns | 82,231.365 | 122ns |
| 126 | 17th St. & Delancy | 7605 | 545 | 51,757.209 | 56ns | 82,236.949 | 127ns |
| 127 | 17th St. & Waverly | 7605 | 545 | 51,757.617 | 34ns | 82,237.543 | 154ns |
| 131 | 16th St. & Lombard | 8020 | 395 | 51,757.059 | 29ns | 82,237.623 | 64ns |
| 132 | 16th St. & Waverly | 8020 | 540 | 51,757.249 | 42ns | 82,237.726 | 87ns |
| 133 | 16th St. & Delancy | 8020 | 935 | 51,756.408 | 40ns | 82,236.737 | 111ns |
| 141 | 16th St. & Arch | 8500 | 3900 | 51,751.488 | 72ns | 82,232.364 | 198ns |
| 152 | Delancy & Rosewood | 8785 | 955 | 51,755.868 | 26ns | 82,231.652 | 50ns |
| 155 | 15th St. & Lombard | 8500 | 340 | 51,757.057 | 34ns | 82,238.030 | 101ns |
| 156 | 15th St. & South | 8500 | 70 | 51,757.840 | 66ns | 82,238.921 | 206ns |
| 157 | 15th St. & Bainbridge | 8500 | - 293 | 51,758.307 | 52ns | 82,239.492 | 90ns |
| 160 | Broad & Bainbridge | 9000 | - 293 | 51,757.331 | 27ns | 82,239.310 | 87ns |
| 161 | Broad & South | 9000 | 45 | 51,756.969 | 20ns | 82,238.859 | 31ns |
| 162 | Broad & Lombard | 9000 | 310 | 51,756.441 | 22ns | 82,238.351 | 44ns |
| 163 | Broad & Pine | 9000 | 690 | 51,756.019 | 34ns | 82,237.836 | 59ns |
| 164 | Broad & Delancy | 9000 | 855 | 51,755.672 | 25ns | 82,237.472 | 84ns |
| 165 | Broad & Spruce | 9000 | 1215 | 51,754.902 | 33ns | 82,236.918 | 79ns |
| 166 | Broad & Locust | 9000 | 1650 | 51,754.285 | 52ns | 82,236.355 | 96ns |
| 167 | Broad & Chancellor | 9010 | 1835 | 51,753.819 | 77ns | 82,235.690 | 162ns |
| 173 | Broad & Arch | 9000 | 3950 | 51,750.620 | 41ns | 82,232.083 | 85ns |
| 176 | Juniper & Pine | 9300 | 675 | 51,755.837 | 83ns | 82,238.194 | 120ns |
| 177 | Juniper & Cypress | 9300 | 1000 | 51,754.818 | 58ns | 82,237.782 | 147ns |
| 207 | 13th St. & Bainbridge | 9580 | - 293 | 51,757.556 | 44ns | 82,240.690 | 67ns |
| 210 | 13th St. & South | 9580 | 45 | 51,756.152 | 20ns | 82,239.433 | 33ns |

LORAN Calibration Data

Sector B (Continued)

| CAL Pt. No. | Intersection | X | Y | TDA Mean TD | TDA Std. Dev. | TDB Mean TD | TDB Std. Dev. |
|---|---|---|---|---|---|---|---|
| 211 | 13th St. & Lombard | 9580 | 380 | 51,754.867 | 72ns | 82,238.679 | 84ns |
| 213 | 13th St. & Pine | 9580 | 710 | 51,755.004 | 31ns | 82,238.220 | 62ns |
| 224 | 12th St. & Arch | 10,000 | 3950 | 51,749.748 | 50ns | 82,233.324 | 131ns |
| 225 | 12th St. & Cuthbert | 10,000 | 3752 | 51,750.156 | 58ns | 82,233.422 | 59ns |
| 226 | 12th St. & Filbert | 10,000 | 3575 | 51,749.375 | 52ns | 82,233.324 | 111ns |
| 227 | 12th St. & Commerce | 10,000 | 3435 | 51,749.948 | 52ns | 82,233.897 | 93ns |
| 236 | 12th St. & Locust | 10,000 | 1640 | 51,753.099 | 34ns | 82,236.840 | 84ns |
| 237 | 12th St. & Spruce | 10,000 | 1225 | 51,753.949 | 59ns | 82,237.433 | 82ns |
| 242 | 12th St. & South | 10,000 | 25 | 51,755.755 | 27ns | 82,239.566 | 60ns |
| 243 | 12th St. & Bainbridge | 10,000 | - 375 | 51,758.185 | 78ns | 82,241.541 | 59ns |
| 244 | Camac & Pine | 9825 | 690 | 51,754.894 | 49ns | 82,238.738 | 90ns |
| 245 | Camac & Spruce | 9810 | 1200 | 51,753.969 | 73ns | 82,237.523 | 243ns |
| 250 | Quince & Lombard | 10,250 | 365 | 51,754.902 | 33ns | 82,239.515 | 56ns |
| 252 | Quince & Spruce | 10,250 | 1200 | 51,753.494 | 122ns | 82,237.873 | 142ns |
| 253 | Quince & Locust | 10,250 | 1640 | 51,752.947 | 48ns | 82,237.157 | 87ns |
| 260 | 11th St. & Lombard | 10,500 | 320 | 51,754.476 | 85ns | 82,239.652 | 109ns |
| 261 | 11th St. & Pine | 10,500 | 690 | 51,753,910 | 43ns | 82,238.664 | 116ns |
| 263 | 11th St. & Locust | 10,500 | 1680 | 51,751.422 | 42ns | 82,236.273 | 83ns |
| 264 | 11th St. & Chancellor | 10,500 | 1875 | 51,750.616 | 72ns | 82,235.937 | 120ns |
| 265 | 11th St. & Walnut | 10,500 | 2085 | 51,751.306 | 163ns | 82,236.080 | 139ns |
| 266 | 11th St. & Sansom | 10,500 | 2350 | 51,749.719 | 54ns | 82,235.519 | 216ns |

Total Number of Calibration Points - 51
Mean Radial Error - 191 feet

LORAN Calibration Data

Sector C

| CAL Pt. No. | Intersection | X | Y | TDA Mean TD | TDA Std. Dev. | TDB Mean TD | TDB Std. Dev. |
|---|---|---|---|---|---|---|---|
| 305 | 10th St. & Spruce | 10,910 | 1275 | 51,753.238 | 100ns | 82,238.567 | 142ns |
| 310 | 10th St. & South | 10,910 | 0 | 51,754.805 | 74ns | 82,240.156 | 70ns |
| 313 | 9th St. & South | 11,355 | 50 | 51,753.883 | 33ns | 82,240.504 | 147ns |
| 314 | 9th St. & Lombard | 11,355 | 320 | 51,753.726 | 42ns | 82,239.495 | 80ns |
| 315 | 9th St. & Pine | 11,370 | 660 | 51,752.871 | 79ns | 82,239.281 | 64ns |
| 317 | 9th St. & Spruce | 11,360 | 1245 | 51,752.430 | 77ns | 82,238.621 | 104ns |
| 320 | 9th St. & Locust | 11,360 | 1675 | 51,751.523 | 26ns | 82,237.816 | 57ns |
| 321 | 9th St. & Walnut | 11,371 | 2030 | 51,750.981 | 22ns | 82,237.289 | 53ns |
| 326 | 8th St. & Ranstead | 11,825 | 2875 | 51,749.449 | 84ns | 82,236.606 | 149ns |
| 327 | 8th St. & Sansom | 11,825 | 2405 | 51,750.106 | 67ns | 82,237.090 | 123ns |
| 330 | 8th St. & Walnut | 11,835 | 2100 | 51,750.590 | 29ns | 82,237.551 | 69ns |
| 333 | Darien & Locust | 11,585 | 1640 | 51,751.297 | 17ns | 82,237.945 | 38ns |
| 334 | Darien & Spruce | 11,585 | 1220 | 51,752.191 | 34ns | 82,238.783 | 76ns |
| 335 | 8th & Spruce | 11,795 | 1220 | 51,751.719 | 74ns | 82,238.519 | 89ns |
| 336 | 8th & Pine | 11,815 | 660 | 51,752.746 | 19ns | 82,239.742 | 100ns |
| 340 | 8th & South | 11,815 | 40 | 51,753.746 | 12ns | 82,240.816 | 29ns |
| 346 | 7th & Spruce | 12,240 | 1255 | 51,751.121 | 61ns | 82,239.101 | 122ns |
| 352 | 7th & Walnut | 12,260 | 2115 | 51,750.008 | 55ns | 82,237.875 | 106ns |
| 354 | 7th & Ranstead | 12,260 | 2865 | 51,748.854 | 28ns | 82,236.606 | 57ns |
| 356 | 7th & Arch | 12,260 | 3865 | 51,747.168 | 46ns | 82,234.878 | 60ns |
| 357 | 6th & Arch | 12,700 | 3995 | 51,746.458 | 20ns | 82,235.147 | 55ns |
| 360 | 6th & Ranstead | 12,695 | 2825 | 51,748.305 | 33ns | 82,236.967 | 62ns |
| 361 | 6th & Sansom | 12,690 | 2335 | 51,749.102 | 49ns | 82,237.875 | 186ns |
| 362 | 6th & Walnut | 12,690 | 2070 | 51,749.609 | 150ns | 82,238.664 | 156ns |
| 365 | 6th & Spruce | 12,680 | 1215 | 51,751.047 | 31ns | 82,239.582 | 78ns |
| 366 | 6th & Pine | 12,675 | 695 | 51,751.734 | 27ns | 82,240.304 | 55ns |
| 370 | 6th & South | 12,655 | 0 | 51,752.879 | 26ns | 82,241.344 | 76ns |
| 373 | 5th & South | 13,120 | 25 | 51,752.023 | 31ns | 82,241.523 | 82ns |
| 374 | 5th & Lombard | 13,125 | 390 | 51,751.559 | 34ns | 82,241.012 | 60ns |
| 375 | 5th & Pine | 13,120 | 700 | 51,750.855 | 34ns | 82,240.346 | 67ns |

LORAN Calibration Data

Sector C (Continued)

| CAL Pt. No. | Intersection | X | Y | TDA Mean TD | TDA Std. Dev. | TDB Mean TD | TDB Std. Dev. |
|---|---|---|---|---|---|---|---|
| 376 | 5th & Spruce | 13,120 | 1210 | 51,750.012 | 37ns | 82,239.336 | 103ns |
| 400 | 5th & Locust | 13,120 | 1660 | 51,748.980 | 57ns | 82,238.490 | 120ns |
| 403 | 5th & Chestnut | 13,145 | 2660 | 51,747.990 | 28ns | 82,237.469 | 33ns |
| 405 | 5th & Market | 13,120 | 3035 | 51,747.223 | 50ns | 82,236.477 | 71ns |
| 407 | 5th & Arch | 13,130 | 4030 | 51,745.559 | 26ns | 82,235.047 | 73ns |
| 410 | 4th & Chestnut | 13,590 | 2705 | 51,747.746 | 37ns | 82,237.773 | 84ns |
| 412 | 4th & Locust | 13,580 | 1685 | 51,749.281 | 20ns | 82,239.406 | 58ns |
| 415 | 4th & Pine | 13,575 | 695 | 51,750.746 | 34ns | 82,240.855 | 62ns |
| 417 | 4th & Lombard | 13,570 | 370 | 51,751.473 | 37ns | 82,241.578 | 64ns |
| 420 | 4th & South | 13,570 | 25 | 51,752.215 | 64ns | 82,242.390 | 116ns |
| 430 | 3rd & Pine | 14,000 | 1245 | 51,750.262 | 37ns | 82,241.484 | 44ns |
| 434 | 3rd St. & Walnut | 14,000 | 2045 | 51,748.098 | 26ns | 82,239.000 | 49ns |
| 435 | 3rd St. & Chestnut | 14,000 | 2605 | 51,747.305 | 12ns | 82,238.179 | 33ns |

Total Calibration Points - 43
Mean Radial Error - 148 feet

## LORAN Calibration Data
## Sector D

| CAL Pt. No. | Intersection | X | Y | TDA Mean TD | TDA Std. Dev. | TDB Mean TD | TDB Std. Dev. |
|---|---|---|---|---|---|---|---|
| 451 | Vine & 24th St. | 4320 | 5790 | 51,754.062 | 32ns | 82,227.512 | 49ns |
| 454 | 24th St. & Green | 4370 | 7385 | 51,750.833 | 34ns | 82,224.644 | 24ns |
| 455 | 23rd St. & Brandywine | 4830 | 7130 | 51,750.750 | 38ns | 82,225.299 | 78ns |
| 457 | 22nd St. & Green | 5270 | 7410 | 51,749.783 | 28ns | 82,224.839 | 50ns |
| 461 | 21st St. & Hamilton | 5720 | 6370 | 51,750.937 | 26ns | 82,226.726 | 17ns |
| 463 | 20th St. & Nectarine | 6280 | 6725 | 51,749.648 | 18ns | 82,226.359 | 61ns |
| 466 | 19th St. & Brandywine | 6725 | 7120 | 51,748.576 | 71ns | 82,226.063 | 117ns |
| 467 | 19th St. & Spg. Garden | 6725 | 6910 | 51,748.930 | 20ns | 82,226.707 | 69ns |
| 471 | 19th St. & Hamilton | 6725 | 6390 | 51,749.402 | 41ns | 82,227.137 | 85ns |
| 473 | 19th St. & Callowhill | 6725 | 5820 | 51,750.890 | 79ns | 82,228.445 | 86ns |
| 475 | 19th St. & Wood | 6725 | 5535 | 51,751.227 | 38ns | 82,228.957 | 64ns |
| 476 | 18th St. & Brandywine | 7225 | 7130 | 51,748.203 | 39ns | 82,226.367 | 234ns |
| 502 | 17th St. & Buttonwood | 7640 | 6630 | 51,747.984 | 27ns | 82,227.644 | 49ns |
| 503 | 17th St. & Callowhill | 7640 | 5840 | 51,749.469 | 42ns | 82,228.781 | 68ns |
| 507 | 17th St. & Race | 7620 | 4520 | 51,751.270 | 33ns | 82,230.707 | 70ns |
| 512 | 15th St. & Brandywine | 8500 | 7140 | 51,746.648 | 58ns | 82,227.395 | 71ns |
| 514 | 15th St. & Hamilton | 8500 | 6400 | 51,747.773 | 48ns | 82,228.433 | 46ns |
| 515 | 15th St. & Callowhill | 8500 | 5890 | 51,748.543 | 41ns | 82,229.171 | 55ns |
| 517 | 15th St. & Vine | 8500 | 5360 | 51,749.441 | 26ns | 82,230.018 | 41ns |
| 521 | 15th St. & Race | 8500 | 4630 | 51,760.628 | 85ns | 82,231.141 | 111ns |
| 522 | 15th St. & Cherry | 8500 | 4295 | 51,750.707 | 36ns | 82,231.536 | 76ns |
| 524 | Broad & Brandywine | 9000 | 7170 | 51,746.008 | 31ns | 82,227.520 | 42ns |
| 530 | Juniper & Cherry | 9265 | 4270 | 51,750.326 | 52ns | 82,232.078 | 126ns |
| 533 | 12th St. & Spg. Garden | 10,040 | 6815 | 51,745.504 | 34ns | 82,228.832 | 57ns |
| 535 | 12th St. & Buttonwood | 10,040 | 6715 | 51,745.523 | 27ns | 82,228.890 | 62ns |
| 537 | 12th St. & Noble | 10,040 | 6380 | 51,746.379 | 37ns | 82,229.938 | 134ns |
| 540 | 12th St. & Callowhill | 10,040 | 5900 | 51,746.699 | 42ns | 82,230.145 | 76ns |
| 543 | 12th St. & Vine | 10,040 | 5270 | 51,747.679 | 31ns | 82,231.185 | 59ns |
| 546 | 12th St. & Race | 10,040 | 4655 | 51,748.594 | 73ns | 82,232.387 | 252ns |
| 552 | 22nd St. & Winter | 5280 | 5090 | 51,753.332 | 19ns | 82,238.434 | 89ns |
| 553 | 21st St. & Winter | 5720 | 5090 | 51,752.906 | 38ns | 82,238.672 | 69ns |

## LORAN Calibration Data

### Sector D (Continued)

| CAL Pt. No. | Intersection | X | Y | TDA Mean TD | TDA Std. Dev. | TDB Mean TD | TDB Std. Dev. |
|---|---|---|---|---|---|---|---|
| 554 | Race & Woodstock | 6075 | 4560 | 51,753.145 | 50ns | 82,239.492 | 90ns |
| 557 | 31st St. & Spg. Garden | 1734 | 6031 | 51,755.772 | 26ns | 82,234.875 | 64ns |
| 560 | 32nd St. & Howelton | 1750 | 5000 | 51,757.000 | 25ns | 82,236.334 | 89ns |
| 562 | 32nd St. & Arch | 1950 | 3848 | 51,758.277 | 34ns | 82,237.582 | 63ns |

## LORAN Calibration Data

### Sector Special Case - LORAN Only Area

| CAL Pt. No. | Intersection | X | Y | TDA Mean TD | TDA Std. Dev. | TDB Mean TD | TDB Std. Dev. |
|---|---|---|---|---|---|---|---|
| 600 | 4th St. & Ducannon | 1633 | 609 | 51,705.629 | 41ns | 82,193.546 | 58ns |
| 601 | 4th St. & Lindley | 1633 | 1156 | 51,706.520 | 50ns | 82,193.395 | 60ns |
| 602 | 4th St. & Ruscomb | 1633 | 1719 | 51,707.305 | 37ns | 82,194.094 | 66ns |
| 603 | 4th St. & Rockland | 1633 | 2312 | 51,708.183 | 81ns | 82,195.063 | 96ns |
| 604 | 4th St. & Loudon | 1633 | 2835 | 51,709.019 | 29ns | 82,195.488 | 67ns |
| 605 | 4th St. & Wyoming | 1633 | 3398 | 51,709.879 | 54ns | 82,196.719 | 74ns |
| 606 | 10th St. & Wyoming | 1172 | 3398 | 51,711.410 | 50ns | 82,196.188 | 38ns |
| 607 | 10th St. & Loudon | 1172 | 2835 | 51,710.156 | 32ns | 82,195.027 | 58ns |
| 610 | 10th St. & Rockland | 1172 | 2312 | 51,710.176 | 70ns | 82,195.766 | 128ns |
| 611 | 10th St. & Ruscomb | 1172 | 1719 | 51,708.297 | 64ns | 82,192.961 | 95ns |
| 612 | 10th St. & Lindley | 1172 | 1156 | 51,707.633 | 42ns | 82,193.430 | 105ns |
| 613 | 10th St. & Ducannon | 1172 | 609 | 51,706.984 | 55ns | 82,193.402 | 117ns |
| 614 | Hutchinson & Ducannon | 1375 | 609 | 51,706.109 | 38ns | 82,192.832 | 53ns |
| 615 | Hutchinson & Lindley | 1375 | 1156 | 51,706.887 | 76ns | 82,193.234 | 105ns |
| 616 | Hutchinson & Ruscomb | 1375 | 1719 | 51,707.472 | 26ns | 82,193.992 | 51ns |
| 617 | Hutchinson & Rockland | 1375 | 2312 | 51,708.766 | 59ns | 82,195.020 | 74ns |
| 620 | Hutchinson & Loudon | 1375 | 2835 | 51,709.230 | 49ns | 82,195.254 | 101ns |
| 621 | Hutchinson & Wyoming | 1375 | 3398 | 51,710.320 | 25ns | 82,196.367 | 45ns |
| 622 | Warnock & Wyoming | 945 | 3398 | 51,710.555 | 25ns | 82,196.125 | 51ns |
| 623 | Warnock & Loudon | 945 | 2835 | 51,709.676 | 61ns | 82,195.309 | 87ns |
| 624 | Warnock & Rockland | 945 | 2312 | 51,710.347 | 57ns | 82,195.451 | 90ns |
| 625 | Warnock & Ruscomb | 945 | 1719 | 51,707.965 | 47ns | 82,193.301 | 105ns |
| 626 | Warnock & Lindley | 945 | 1156 | 51,707.765 | 38ns | 82,193.654 | 98ns |
| 627 | Warnock & Ducannon | 945 | 609 | 51,706.805 | 61ns | 82,192.813 | 98ns |
| 630 | 11th St. & Ducannon | 723 | 609 | 51,707.241 | 75ns | 82,192.500 | 162ns |
| 631 | 11th St. & Lindley | 723 | 1156 | 51,707.339 | 50ns | 82,192.891 | 101ns |
| 632 | 11th St. & Ruscomb | 723 | 1719 | 51,708.778 | 63ns | 82,192.868 | 98ns |
| 633 | 11th St. & Rockland | 723 | 2312 | 51,709.201 | 40ns | 82,194.492 | 39ns |
| 634 | 11th St. & Loudon | 723 | 2835 | 51,710.184 | 26ns | 82,195.313 | 55ns |
| 635 | 11th St. & Wyoming | 723 | 3398 | 51,711.027 | 41ns | 82,195.824 | 65ns |

LORAN Calibration Data

Sector Special Case (Continued)

| CAL Pt. No. | Intersection | X | Y | TDA | | TDB | |
|---|---|---|---|---|---|---|---|
| | | | | Mean TD | Std. Dev. | Mean TD | Std. Dev. |
| 636 | Marvine & Wyoming | 500 | 3398 | 51,711.152 | 64ns | 82,195.824 | 54ns |
| 637 | Marvine & Loudon | 500 | 2835 | 51,710.031 | 31ns | 82,194.988 | 37ns |
| 640 | Marvine & Rockland | 500 | 2312 | 51,709.160 | 46ns | 82,194.164 | 42ns |
| 641 | Marvine & Ruscomb | 500 | 1719 | 51,708.406 | 16ns | 82,193.148 | 46ns |
| 642 | Marvine & Lindley | 500 | 1156 | 51,707.348 | 39ns | 82,192.699 | 65ns |
| 643 | Marvine & Ducannon | 500 | 609 | 51,706.938 | 62ns | 82,192.004 | 109ns |
| 644 | 12th St. & Ducannon | 313 | 609 | 51,706.816 | 46ns | 82,191.625 | 106ns |
| 645 | 12th St. & Lindley | 313 | 1164 | 51,707.750 | 20ns | 82,192.500 | 32ns |
| 646 | 12th St. & Ruscomb | 313 | 1719 | 51,708.582 | 45ns | 82,193.133 | 75ns |
| 647 | 12th St. & Rockland | 313 | 2312 | 51,709.535 | 43ns | 82,194.051 | 99ns |
| 650 | 12th St. & Loudon | 313 | 2835 | 51,710.168 | 64ns | 82,194.824 | 87ns |
| 651 | 12th St. & Wyoming | 313 | 3398 | 51,711.352 | 69ns | 82,195.637 | 61ns |
| 652 | Windbrim & Marvine | 500 | 340 | 51,704.324 | 45ns | 82,192.816 | 81ns |
| 653 | Windbrim & 11th St. | 723 | 156 | 51,707.023 | 16ns | 82,191.230 | 56ns |
| 654 | Windbrim & Warnock | 945 | 55 | 51,705.941 | 29ns | 82,191.277 | 64ns |
| 655 | Fisher & 10th St. | 1172 | 23 | 51,705.383 | 25ns | 82,191.398 | 44ns |
| 656 | Fisher & Hutchinson | 1375 | 18 | 51,704.586 | 27ns | 82,191.113 | 94ns |
| 657 | Fisher & 4th St. | 1633 | 10 | 51,704.492 | 32ns | 82,191.328 | 49ns |

## LORAN Calibration Data

### Sector Special Case - Unusual Coverage Bridge Area

| CAL Pt. No. | Intersection | X | Y | TDA Mean TD | TDA Std. Dev. | TDB Mean TD | TDB Std. Dev. |
|---|---|---|---|---|---|---|---|
| 700 | North & Point | 19,452 | 6,188 | 51,731.940 | 115 ns | 82,232.207 | 109 ns |
| 701 | Delaware & Penn | 19,149 | 3,751 | 51,740.070 | 31 ns | 82,239.690 | 25 ns |
| 702 | State & 2nd | 20,216 | 5,566 | 51,736.186 | 38 ns | 82,237.800 | 76 ns |
| 703 | 5th & Penn | 21,164 | 2,642 | 51,737.898 | 40 ns | 82,241.163 | 36 ns |
| 704 | Willow & 2nd | 14,607 | 6,237 | 51,741.132 | 26 ns | 82,232.917 | 41 ns |
| 705 | 4th & Arch | 13,528 | 4,024 | 51,745.183 | 37 ns | 82,235.105 | 107 ns |
| 706 | Race & Delaware | 15,412 | 4,596 | 51,742.890 | 32 ns | 82,236.089 | 75 ns |
| 707 | Front & Chestnut | 15,069 | 2,661 | 51,746.093 | 32 ns | 82,238.875 | 36 ns |
| 710 | 4th & Walnut | 13,591 | 2,077 | 51,748.425 | 32 ns | 82,238.550 | 91 ns |

## A.2 CALIBRATION DATA REDUCTION PROGRAM AND SAMPLE PROGRAM EXECUTION (BRIDGE RUN)

```
REMOTE          START JOB 261   CALIB261 CUST=06689551003       I.D.=ESMS0035 TERM.=9013 DATE=FRI. 11 MAR 1977          TIME=17.06.53
REMOTE          START JOB 261   CALIB261 CUST=06689551003       I.D.=ESMS0035 TERM.=9013 DATE=FRI. 11 MAR 1977          TIME=17.06.53
REMOTE          START JOB 261   CALIB261 CUST=06689551003       I.D.=ESMS0035 TERM.=9013 DATE=FRI. 11 MAR 1977          TIME=17.06.53


                                               H A S P    S Y S T E M    L O G

$ 16.50.22 JOB 261 -- CALIB261 -- BEGINNING EXEC - INIT A - CLASS A
$ 16.54.36 JOB 261 END EXECUTION.





SYSTEM/JOB STATISTICS ------------------------------ TELEDYNE RYAN AERONAUTICAL ------------------------------ SYSTEM/JOB STATISTICS


O/S MVT RELEASE 21.8B WITH HASP-II VERSION 3.1, CICS VERSION 2.3 WITH DL/I VERSION 2.4.1 AND TSO RELEASE 21.8B WITH TCAM LEVEL SE.
370/155 2.0 MEG., 1-3215, 1-2540, 2-1403, 1-1018, 1-3705, 2-3272, 22-3670, 2-3420 7/9 TRACK DUAL-DEN, 6-3420 9 TRACK 1600BPI.


   0.21 MIN CPU TIME --  MU=       .29 --     344 CARDS READ --       811 LINES PRINTED --       0 CARDS PUNCHED -- TIME ON READER 16.30
```

```
//CALIB261 JOB (ESMS0035,9999,2,1),'06689551003',                          , JOB 261
// TIME=0002,MSGLEVEL=1,REGION=100K
// EXEC FORTGCLG
XXFORT      EXEC PGM=IEYFORT,REGION=100K                                    00000100
XXSYSPRINT DD  SYSOUT=A                                                      00000200
XXSYSPUNCH DD  SYSOUT=B                                                      00000300
XXSYSLIN    DD  UNIT=SYSDA,DISP=(MOD,PASS),SPACE=(80,(200,100),RLSE),       00000400
XX               DSN=&&LOADSET,DCB=BLKSIZE=80                                00000500
//SYSIN  DD *
IEF236I ALLOC. FOR CALIB261 FORT
IEF237I 0E7   ALLOCATED TO SYSPRINT
IEF237I 0D1   ALLOCATED TO SYSPUNCH
IEF237I 253   ALLOCATED TO SYSLIN
IEF237I 0B9   ALLOCATED TO SYSIN
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS77069.T044750.RV000.CALIB261.LOADSET        PASSED
IEF285I   VOL SER NOS= WORK03.
IEF373I STEP /FORT     / START 77070.1650
IEF374I STEP /FORT     / STOP  77070.1652 CPU   0MIN 10.13SEC MAIN  90K LCS   0K
XXLKED EXEC PGM=IEWL,REGION=110K,PARM=(XREF,LET,LIST),COND=(4,LT,FORT)  00000600
XXSYSLIB    DD  DSNAME=SYS1.FORTLIB,DISP=SHR                                 00000700
XXSYSPRINT DD  SYSOUT=A                                                      00000800
XXSYSLMOD  DD  UNIT=SYSDA,DISP=(NEW,PASS),SPACE=(1024,(20,10,1),RLSE),      00000900
XX               DSN=&&GOSET(MAIN),DCB=BLKSIZE=1024                          00001000
XXSYSUT1    DD  UNIT=SYSDA,SPACE=(1024,(100,10)),DCB=BLKSIZE=1024           00001100
XXSYSLIN    DD  DSN=&&LOADSET,DISP=(OLD,DELETE)                              00001200
XX           DD  DDNAME=SYSIN                                                00001300
IEF236I ALLOC. FOR CALIB261 LKED
IEF237I 130   ALLOCATED TO SYSLIB
IEF237I 0F0   ALLOCATED TO SYSPRINT
IEF237I 253   ALLOCATED TO SYSLMOD
IEF237I 252   ALLOCATED TO SYSUT1
IEF237I 253   ALLOCATED TO SYSLIN
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS1.FORTLIB                                   KEPT
IEF285I   VOL SER NOS= SYS218.
IEF285I   SYS77069.T044750.RV000.CALIB261.GOSET          PASSED
IEF285I   VOL SER NOS= WORK03.
IEF285I   SYS77069.T044750.RV000.CALIB261.R0012248       DELETED
IEF285I   VOL SER NOS= WORK02.
IEF285I   SYS77069.T044750.RV000.CALIB261.LOADSET        DELETED
IEF285I   VOL SER NOS= WORK03.
IEF373I STEP /LKED     / START 77070.1652
IEF374I STEP /LKED     / STOP  77070.1654 CPU   0MIN 02.19SEC MAIN 100K LCS   0K
XXGO EXEC PGM=*.LKED.SYSLMOD,COND=((4,LT,FORT),(4,LT,LKED))                 00001400
XXFT05F001 DD  DDNAME=SYSIN                                                  00001500
XXFT06F001 DD  SYSOUT=A                                                      00001600
XXFT07F001 DD  SYSOUT=B                                                      00001700
//GO.SYSIN DD *
//
IEF236I ALLOC. FOR CALIB261 GO
IEF237I 253   ALLOCATED TO PGM=*.DD
IEF237I 0BF   ALLOCATED TO FT05F001
IEF237I 0E0   ALLOCATED TO FT06F001
IEF237I 0D1   ALLOCATED TO FT07F001
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS77069.T044750.RV000.CALIB261.GOSET          PASSED
IEF285I   VOL SER NOS= WORK03.
IEF373I STEP /GO       / START 77070.1654
IEF374I STEP /GO       / STOP  77070.1654 CPU   0MIN 00.82SEC MAIN  68K LCS   0K
```

```
IEF285I   SYS77069.T044750.RV000.CALIB261.GOSET         DELETED
IEF285I   VOL SER NOS= WORK03.
IEF375I  JOB /CALIB261/ START 77070.1650
IEF376I  JOB /CALIB261/ STOP  77070.1654 CPU    0MIN 13.14SEC
```

```
FORTRAN IV G LEVEL  21                 MAIN                DATE = 77070          16/50/31             PAGE 0001

                C      THIS DECK IS A STAND ALONE DECK FOR CALIBRATION
 0001                  COMMON/INOTPT/ITA,ITB,IX,IY
 0002                  ITA=1
 0003                  ITB=2
 0004                  IX=3
 0005                  IY=4
                C      READ TOTAL NUMBER OF SECTORS
 0006                  READ(5,10) NSECTS
 0007              10  FORMAT(I5)
 0008                  WRITE(6,20) NSECTS
 0009              20  FORMAT('0','NSECTS=',I5)
 0010                  DO 30 I=1,NSECTS
 0011                  CALL CALIB
 0012              30  CONTINUE
 0013                  END
```

```
FORTRAN IV G LEVEL  21               MAIN             DATE = 77070        16/50/31          PAGE 0002

                                 COMMON BLOCK /INDIPT  / MAP SIZE        10
SYMBOL     LOCATION      SYMBOL     LOCATION      SYMBOL     LOCATION      SYMBOL     LOCATION      SYMBOL     LOCATION
ITA               0      ITB               4      IX                8      IY                C


                                 SUBPROGRAMS CALLED
SYMBOL     LOCATION      SYMBOL     LOCATION      SYMBOL     LOCATION      SYMBOL     LOCATION      SYMBOL     LOCATION
IBCOM#           98      CALIB            9C


                                 SCALAR MAP
SYMBOL     LOCATION      SYMBOL     LOCATION      SYMBOL     LOCATION      SYMBOL     LOCATION      SYMBOL     LOCATION
NSECTS           A0      I                A4


                                 FORMAT STATEMENT MAP
SYMBOL     LOCATION      SYMBOL     LOCATION      SYMBOL     LOCATION      SYMBOL     LOCATION      SYMBOL     LOCATION
    10           A8          20           AC

   *OPTIONS IN EFFECT*  ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
   *OPTIONS IN EFFECT*  NAME = MAIN    , LINECNT =       59
   *STATISTICS*    SOURCE STATEMENTS =       13,PROGRAM SIZE =       444
   *STATISTICS*  NO DIAGNOSTICS GENERATED
```

```
FORTRAN IV G LEVEL  21                 CALIB              DATE = 77070          16/50/31                 PAGE 0001

 0001                 SUBROUTINE CALIB
 0002                 COMMON/CALWRK/WORK(100,5),U(20),V(20)
 0003                 COMMON/CALIBR/ICALID(100)
 0004                 DIMENSION TOS(10,2,20),REF(10,6),SECTRS(10,4)
 0005                 COMMON/INDIPT/ITA,ITB,IX,IY
 0006          2000 FORMAT(I10,(6F10.0))
 0007          2001 FORMAT(16I5)
 0008          2002 FORMAT(' ',I5,6F11.4)
 0009          2003 FORMAT(8F10.3)
 0010          2005 FORMAT('0','INPUT DATA FROM CODING FORMS')
 0011          2006 FORMAT('0','X COEFFS FOR SECTOR',I5,5F12.4)
 0012          2007 FORMAT('0','Y COEFFS FOR SECTOR',I5,5F12.4)
 0013          2008 FORMAT('0','SECTOR NUMBER=',I5,' REF POINT NUMBER=',I5,' NUMBER OF
                  1 CALIBRATION POINTS=',I5)
 0014          2009 FORMAT('0','COORDINATES OF SECTOR BOUNDARY POINTS')
 0015                 READ(5,2001) IN,IR,ISECT,N
 0016                 WRITE(6,2008) ISECT,IR,N
 0017                 READ(5,2003) (SECTRS(ISECT,J),J=1,4)
 0018                 WRITE(6,2009)
 0019                 WRITE(6,2003)  (SECTRS(ISECT,J),J=1,4)
              C       READ CARDS
 0020                 WRITE(6,2005)
 0021           1     DO 10 J=1,N
 0022                 READ(5,2000) ICALID(J),(WORK(J,K),K=1,4),A,B
              C.....KLUGE FOR STAND ALONE LOREN-REMOVE NEXT TWO CARDS AFTER THIS RUN
              C       WORK(J,2)=WORK(J,2)+60.
              C       WORK(J,1)=WORK(J,1)-520.
              C       END OF KLUGE
 0023                 WRITE(6,2002) ICALID(J),(WORK(J,K),K=1,4),A,B
 0024                 WORK(J,5)=A**2+B**2
 0025              10 CONTINUE
 0026                 DO 1000 I=1,N
 0027                 IF(ICALID(I).EQ.IR) IR=I
 0028          1000 CONTINUE
 0029          100    CALL COEF(WORK,U,V,N,IR,IN)
 0030                 IDIM=(IN+1)*(IN+2)/2-1
 0031                 DO 13 J=1,IDIM
 0032                 TOS(ISECT,1,J)=U(J)
 0033          13     TOS(ISECT,2,J)=V(J)
 0034                 WRITE(6,2006) ISECT,(U(J),J=1,5)
 0035                 WRITE(6,2007) ISECT,(V(J),J=1,5)
 0036                 DO 14 J=1,4
 0037          14     REF(ISECT,J)=WORK(IR,J)
 0038                 REF(ISECT,6)=IN
 0039                 REF(ISECT,5)=1.0
 0040                 RETURN
 0041                 END
 FORTRAN IV G LEVEL  21              CALIB            DATE = 77070          16/50/31            PAGE 0002

                                 COMMON BLOCK /CALWRK  / MAP SIZE      870
SYMBOL     LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION
WORK           0          U            700         V            820

                                 COMMON BLOCK /CALIBR  / MAP SIZE      190
SYMBOL     LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION
ICALIB         0

                                 COMMON BLOCK /INDIRT  / MAP SIZE       10
SYMBOL     LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION
ITA            0          ITB            4         IX             8         IY             C

                                 SUBPROGRAMS CALLED
SYMBOL     LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION
IBCOM#        C8          COEF          CC

                                 SCALAR MAP
SYMBOL     LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION
IN            E8          IR            EC         ISECT         F0         N             F4         J             F8
K             FC          A            100         B            104         I            108         IDIM         10C

                                 ARRAY MAP
SYMBOL     LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION
IDS          110          REF          750         SECTRS       840

                                 FORMAT STATEMENT MAP
SYMBOL     LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION
  2000       8E0            2001       8EC           2002       8F2           2003       8FE           2005       905
  2006       928            2007       949           2008       964           2009       969

   *OPTIONS IN EFFECT*  ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
   *OPTIONS IN EFFECT*  NAME = CALIB    , LINECNT =       59
   *STATISTICS*    SOURCE STATEMENTS =       41,PROGRAM SIZE =      3724
   *STATISTICS*  NO DIAGNOSTICS GENERATED
```

```
                  SUBROUTINE COEF(WORK,S,T,INUM,IREF,N)
                  COMMON/INDIPT/ITA,ITB,IX,IY
                  COMMON/CALIBR/ICALID(100)
                  DIMENSION S(1),T(1)
                  DIMENSION WORK(100,1),U(100),V(100)
                  DIMENSION D(100),E(100),H(100,20),U1(20),V1(20),A(20),B(20),G(100)
                  DOUBLE PRECISION U1,V1,E,D,H
             1000 FORMAT(5X,(10E12.4))
             1001 FORMAT(I5,(10E12.4))
             1002 FORMAT(1H1)
             1003 FORMAT(9X,'XC',8X,'X',8X,'ERRX',7X,'YC',8X,'Y',8X,'ERRY',//)
             1004 FORMAT('0','MEAN RADIAL ERROR=',F14.5,' RADIAL ERROR STANDARD DEVI
                 1ATION=',F14.5)
             1005 FORMAT('0','RANK ORDER STATISTICS OF CALIBRATION POINT RADIAL ERRO
                 1RS')
             1006 FORMAT('0','CALIBRATION POINT ERROR MAP')
                  IF( N .NE. 0) GO TO 13
             13   CONTINUE
                  J1=1
                  J2=INUM
                  IDIM=(N+1)*(N+2)/2-1
                  IF(IREF .EQ. 0) GO TO 14
                  J1=IREF
                  J2=IREF
                  G1=1.0 E 20
                  GO TO 15
             14   IREF=1
             15   DO 10 I=J1,J2
                  G(I)=0.0
                  DO 1 K=1,INUM
                  D(K)=(WORK(K,IX)-WORK(I,IX))/WORK(K,5)
             1    E(K)=(WORK(K,IY)-WORK(I,IY))/WORK(K,5)
                  CALL HMAT(WORK,INUM,I,H,N)
                  CALL LINEAR(V1,E ,H,INUM,IDIM)
                  CALL LINEAR(U1,D ,H,INUM,IDIM)
                  WRITE(6,1006)
                  WRITE(6,1003)
                  DO 3 J=1,INUM
                  DELX=0.0
                  DELY=0.0
                  DO 2 K=1,IDIM
                   DELX=DELX+U1(K)*H(J,K)*WORK(J,5)
             2     DELY=DELY+V1(K)*H(J,K)*WORK(J,5)
                  DX=DELX-D(J)*WORK(J,5)
                  DY=DELY-E(J)*WORK(J,5)
                  U(J)=WORK(IREF,IX)+DELX
                  V(J)=WORK(IREF,IY)+DELY
                  AX=DX**2+DY**2
                  AX=SQRT(AX)
                  WRITE(6,1001) ICALID(J),U(J),WORK(J,IX),DX,V(J),WORK(J,IY),DY,AX
                  U(J)=AX
             3    G(I)=G(I)+DX**2+DY**2
                  CALL RANK(U,INUM)
                  CALL MEAN(U,INUM,RMEAN,VAR,SIGR)
                  WRITE(6,1005)
                  DO 20 J=1,INUM
             20   WRITE(6,1001) J,U(J)
```

```
FORTRAN IV G LEVEL  21                  COEF                DATE = 77070        16/50/31            PAGE 0002

 0056                   IF (I .NE. 1) GO TO 5
 0057                   G1=G(I)
 0058                   GO TO 4
 0059          5        IF(G1.LT. G(I)) GO TO 10
 0060                   G1=G(I)
 0061                   IREF=I
 0062          4        DO 6 K=1,IDIM
 0063                   S(K)=U1(K)
 0064                 6 T(K)=V1(K)
 0065         10        CONTINUE
 0066                   WRITE(6,1004) RMEAN,SIGM
 0067                   RETURN
 0068                   END
```

```
FORTRAN IV G LEVEL  21                  COEF               DATE = 77070          16/50/31            PAGE 0003

                                 COMMON BLOCK /INDIPT  / MAP SIZE      10
SYMBOL     LOCATION        SYMBOL    LOCATION       SYMBOL    LOCATION        SYMBOL    LOCATION        SYMBOL    LOCATION
ITA               0        ITB              4       IX               8        IY               C

                                 COMMON BLOCK /CALIBR  / MAP SIZE     190
SYMBOL     LOCATION        SYMBOL    LOCATION       SYMBOL    LOCATION        SYMBOL    LOCATION        SYMBOL    LOCATION
ICALID            0

                                 SUBPROGRAMS CALLED
SYMBOL     LOCATION        SYMBOL    LOCATION       SYMBOL    LOCATION        SYMBOL    LOCATION        SYMBOL    LOCATION
HMAT             F4        LINEAR          F8       IHCOM#          FC        RANK           100        MEAN           104
SQRT            108

                                 SCALAR MAP
SYMBOL     LOCATION        SYMBOL    LOCATION       SYMBOL    LOCATION        SYMBOL    LOCATION        SYMBOL    LOCATION
N               168        J1             16C       I2             170        INUM           174        IDIM           178
IREF            17C        G1             180       I              184        K              188        J              18C
DELX            190        DELY           194       DX             198        DY             19C        AX             1A0
RMEAN           1A4        VAR            1A8       SIGR           1AC

                                 ARRAY MAP
SYMBOL     LOCATION        SYMBOL    LOCATION       SYMBOL    LOCATION        SYMBOL    LOCATION        SYMBOL    LOCATION
S               1B0        T              1B4       WORK           1B8        U              1BC        V              34C
D               4E0        F              800       H              820        U1            49A0        V1            4A40
A              4AE0        R             4B30       G             4B80

                                 FORMAT STATEMENT MAP
SYMBOL     LOCATION        SYMBOL    LOCATION       SYMBOL    LOCATION        SYMBOL    LOCATION        SYMBOL    LOCATION
  1000         4D10          1001        4D1C         1002        4D28          1003        4D2D          1004        4D57
  1005         4D99          1006        4DD8

  *OPTIONS IN EFFECT*  ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
  *OPTIONS IN EFFECT*  NAME = COEF     , LINECNT =       59
  *STATISTICS*    SOURCE STATEMENTS =       68,PROGRAM SIZE =    21716
  *STATISTICS*  NO DIAGNOSTICS GENERATED
```

```
FORTRAN IV G LEVEL  21                  MEAN              DATE = 77070          16/50/31               PAGE 0001

 0001                     SUBROUTINE MEAN(ERR,ICOUNT,RMEAN,VAR,SIGMA)
 0002                     DIMENSION ERR(1)
 0003                     DOUBLE PRECISION SUM,SUMSQ
 0004                     SUM=0.0
 0005                     SUMSQ=0.0
 0006                     RMEAN=0.0
 0007                     VAR=0.0
 0008                     SIGMA=0.0
 0009                     IF(ICOUNT .EQ. 0) RETURN
 0010                     DO 2 J=1,ICOUNT
 0011               2     SUM=SUM+ERR(J)
 0012                     RMEAN=SUM/ICOUNT
 0013                     IF(ICOUNT .EQ. 1) RETURN
 0014                     DO 3 J=1,ICOUNT
 0015               3     SUMSQ=SUMSQ+(ERR(J)-RMEAN)**2
 0016                     VAR=SUMSQ/ICOUNT
 0017                     SIGMA=SQRT(VAR)
 0018                     RETURN
 0019                     END
```

```
FORTRAN IV G LEVEL  21                 MEAN              DATE = 77070         16/50/31           PAGE 0002

                                SUBPROGRAMS CALLED
SYMBOL     LOCATION       SYMBOL     LOCATION       SYMBOL     LOCATION       SYMBOL     LOCATION       SYMBOL     LOCATION
SQRT           A0

                                SCALAR MAP
SYMBOL     LOCATION       SYMBOL     LOCATION       SYMBOL     LOCATION       SYMBOL     LOCATION       SYMBOL     LOCATION
SUM            A8         SUMSQ          B0         RMEAN          B8         VAR            BC         SIGMA          C0
ICOUNT         C4         J              C8

                                ARRAY MAP
SYMBOL     LOCATION       SYMBOL     LOCATION       SYMBOL     LOCATION       SYMBOL     LOCATION       SYMBOL     LOCATION
ERR            CC

   *OPTIONS IN EFFECT*  ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
   *OPTIONS IN EFFECT*  NAME = MEAN    , LINECNT =       59
   *STATISTICS*    SOURCE STATEMENTS =       19,PROGRAM SIZE =       704
   *STATISTICS*  NO DIAGNOSTICS GENERATED
```

```
FORTRAN IV G LEVEL  21                 HMAT                DATE = 77070          16/50/31              PAGE 0001

 0001                      SUBROUTINE HMAT(WORK,INUM,IREF,D,N)
 0002                      COMMON/INPIPT/ITA,ITB,IX,IY
 0003                      DIMENSION WORK(100,1),D(100,1)
 0004                      DIMENSION C(20)
 0005                      DOUBLE PRECISION D
 0006                      IDIM=(N+1)*(N+2)/2-1
 0007                      DO 1 J=1,INUM
 0008                      A=WORK(J,ITA)-WORK(IREF,ITA)
 0009                      B=WORK(J,ITB)-WORK(IREF,ITB)
 0010                      CALL EXPAND(A,B,C,N)
 0011                      DO 1 K=1,IDIM
 0012                1     D(J,K)=C(K)/WORK(I,5)
 0013                      RETURN
 0014                      END
```

```
FORTRAN IV G LEVEL  21                 HMAT                DATE = 77070         16/50/31             PAGE 0002

                                    COMMON BLOCK /INDIPT  / MAP SIZE       10
SYMBOL     LOCATION        SYMBOL     LOCATION      SYMBOL     LOCATION       SYMBOL     LOCATION        SYMBOL     LOCATION
ITA            0           ITB            4         IX             8          IY             C

                                    SUBPROGRAMS CALLED
SYMBOL     LOCATION        SYMBOL     LOCATION      SYMBOL     LOCATION       SYMBOL     LOCATION        SYMBOL     LOCATION
EXPAND        9C

                                    SCALAR MAP
SYMBOL     LOCATION        SYMBOL     LOCATION      SYMBOL     LOCATION       SYMBOL     LOCATION        SYMBOL     LOCATION
IDTM          B0           N             B4         J             B8          INUM          BC          A             C0
IREF          C4           M             C8         K             CC

                                    ARRAY MAP
SYMBOL     LOCATION        SYMBOL     LOCATION      SYMBOL     LOCATION       SYMBOL     LOCATION        SYMBOL     LOCATION
WORK          D0           D             D4         C             D8

   *OPTIONS IN EFFECT*  ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
   *OPTIONS IN EFFECT*  NAME = HMAT    , LINECNT =       59
   *STATISTICS*    SOURCE STATEMENTS =       14,PROGRAM SIZE =       842
   *STATISTICS*  NO DIAGNOSTICS GENERATED
```

```
FORTRAN IV G LEVEL  21                    LINEAR              DATE = 77070          16/50/31            PAGE 0001

 0001                  SUBROUTINE LINEAR(X,Z,H,M,N)
 0002                  DIMENSION H(100,1),X(1),Z(1)
 0003                  DIMENSION A(20,20),B(20,20)
 0004                  DIMENSION C(20)
 0005                  DOUBLE PRECISION X,Z,H,A,B,C,D
 0006                  DO 1 I=1,N
 0007                  DO 1 J=1,N
 0008                  A(I,J)=0.0
 0009                  DO 1 K=1,M
 0010            1     A(I,J)=A(I,J)+H(K,I)*H(K,J)
 0011                  DO 2 I=1,N
 0012                  C(I)=0.
 0013                  DO 2 J=1,M
 0014            2     C(I)=C(I)+H(J,I)*Z(J)
 0015                  CALL DECOMP(N,A,B)
 0016                  CALL SOLVE(N,B,C,X)
                C      CALL IMPRUV(N,A,B,C,X,D)
                C      CALL LINERR(A,C,X,N)
 0017                  RETURN
 0018                  END
```

```
FORTRAN IV G LEVEL  21                LINEAR            DATE = 77070          16/50/31           PAGE 0002

                                 SUBPROGRAMS CALLED
SYMBOL      LOCATION       SYMBOL     LOCATION       SYMBOL      LOCATION       SYMBOL      LOCATION       SYMBOL      LOCATION
DECOMP         A8          SOLVE         AC

                                 SCALAR MAP
SYMBOL      LOCATION       SYMBOL     LOCATION       SYMBOL      LOCATION       SYMBOL      LOCATION       SYMBOL      LOCATION
I              CC          N             D0          J              D4          K              DA          M              DC

                                 ARRAY MAP
SYMBOL      LOCATION       SYMBOL     LOCATION       SYMBOL      LOCATION       SYMBOL      LOCATION       SYMBOL      LOCATION
H              E0          X             E4          Z              E8          A              F0          B             D70
C            19F0

   *OPTIONS IN EFFECT*  ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
   *OPTIONS IN EFFECT*  NAME = LINEAR  , LINECNT =       59
   *STATISTICS*    SOURCE STATEMENTS =       18,PROGRAM SIZE =     7402
   *STATISTICS*  NO DIAGNOSTICS GENERATED
```

```
      SUBROUTINE DECOMP (NN, A, UL)
      IMPLICIT REAL*8 (A-H,O-Z)
      DIMENSION A(20,20), UL(20,20), SCALES(20), IPS(20)
      COMMON IPS
      N = NN
C
C     INITIALIZE IPS, UL AND SCALES
      DO 5 I = 1,N
      IPS(I) = I
      ROWNRM = 0.0
      DO 2 J = 1,N
      UL(I,J) = A(I,J)
      IF(ROWNRM-DABS(UL(I,J))) 1,2,2
    1 ROWNRM =DABS(UL(I,J))
    2 CONTINUE
      IF (ROWNRM) 3,4,3
    3 SCALES(I) = 1.0/ROWNRM
      GO TO 5
    4 CALL SING(1)
      SCALES(I) = 0.0
    5 CONTINUE
C
C     GAUSSIAN ELIMINATION WITH PARTIAL PIVOTING
      NM1 = N-1
      DO 17 K = 1,NM1
      BIG = 0.0
      DO 11 I = K,N
      IP = IPS(I)
      SIZE =DABS(UL(IP,K))*SCALES(IP)
      IF (SIZE-BIG) 11,11,10
   10 BIG = SIZE
      IDXPIV = I
   11 CONTINUE
      IF (BIG) 13,12,13
   12 CALL SING(2)
      GO TO 17
   13 IF (IDXPIV-K) 14,15,14
   14 J = IPS(K)
      IPS(K) = IPS(IDXPIV)
      IPS(IDXPIV) = J
   15 KP = IPS(K)
      PIVOT = UL(KP,K)
      KP1 = K+1
      DO 16 I = KP1,N
      IP = IPS(I)
      EM = -UL(IP,K)/PIVOT
      UL(IP,K) = -EM
      DO 16 J = KP1,N
      UL(IP,J) = UL(IP,J) + EM*UL(KP,J)
C     INNER LOOP. USE MACHINE LANGUAGE CODING IF COMPILER
C     DOES NOT PRODUCE EFFICIENT CODE.
   16 CONTINUE
   17 CONTINUE
      KP = IPS(N)
      IF (UL(KP,N)) 19,18,19
   18 CALL SING(2)
   19 RETURN
```

```
FORTRAN IV G LEVEL  21              DECOMP          DATE = 77070       16/50/31           PAGE 0002
  0052              END
```

```
FORTRAN IV G LEVEL  21              DECOMP            DATE = 77070          16/50/31            PAGE 0003


                          COMMON BLOCK /          / MAP SIZE        50
SYMBOL    LOCATION      SYMBOL    LOCATION      SYMBOL    LOCATION      SYMBOL    LOCATION      SYMBOL    LOCATION
IPS              0


                          SUBPROGRAMS CALLED
SYMBOL    LOCATION      SYMBOL    LOCATION      SYMBOL    LOCATION      SYMBOL    LOCATION      SYMBOL    LOCATION
SING           11C


                          SCALAR MAP
SYMBOL    LOCATION      SYMBOL    LOCATION      SYMBOL    LOCATION      SYMBOL    LOCATION      SYMBOL    LOCATION
ROWNRM         138      BIG            140      SIZE           148      PIVOT          150      EM             158
N              160      NN             164      I              168      J              16C      NM1            170
K              174      IP             178      IDXPIV         17C      KP             180      KP1            184


                          ARRAY MAP
SYMBOL    LOCATION      SYMBOL    LOCATION      SYMBOL    LOCATION      SYMBOL    LOCATION      SYMBOL    LOCATION
A              188      UL             1AC      SCALES         190

   *OPTIONS IN EFFECT*  ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
   *OPTIONS IN EFFECT*  NAME = DECOMP  , LINECNT =       59
   *STATISTICS*    SOURCE STATEMENTS =       52,PROGRAM SIZE =      1630
   *STATISTICS*  NO DIAGNOSTICS GENERATED
```

```
FORTRAN IV G LEVEL  21                 EXPAND            DATE = 77070         16/50/31              PAGE 0001

  0001                   SUBROUTINE EXPAND(X,Y,D,N)
  0002                   DIMENSION D(1)
  0003                   IADD=0
  0004                   DO 10 I=1,N
  0005                   I1=I +1
  0006                   DO 9 J=1,I1
  0007                   IF(J .NE. 1 .AND.J .NE. I1 ) GO TO 8
  0008                   IF(J .EQ. 1) D(IADD+J)=X**(I1-J)
  0009                   IF(J .EQ. I1) D(IADD+J)=Y**(J-1)
  0010                   GO TO 9
  0011             8     D(IADD+J)=X**(I1-J)*Y**(J-1)
  0012             9     CONTINUE
  0013            10     IADD=IADD+I1
  0014                   RETURN
  0015                   END
```

```
FORTRAN IV G LEVEL  21                EXPAND              DATE = 77070        16/50/31            PAGE 0002

                                   SUBPROGRAMS CALLED
 SYMBOL     LOCATION       SYMBOL     LOCATION       SYMBOL     LOCATION       SYMBOL     LOCATION       SYMBOL     LOCATION
 FRXPI=        84

                                   SCALAR MAP
 SYMBOL     LOCATION       SYMBOL     LOCATION       SYMBOL     LOCATION       SYMBOL     LOCATION       SYMBOL     LOCATION
 IADD          D8          I              DC         N              E0         I1             E4         J              E8
 X             EC          Y              F0

                                   ARRAY MAP
 SYMBOL     LOCATION       SYMBOL     LOCATION       SYMBOL     LOCATION       SYMBOL     LOCATION       SYMBOL     LOCATION
 D             F4

     *OPTIONS IN EFFECT*  ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
     *OPTIONS IN EFFECT*  NAME = EXPAND  , LINECNT =       59
     *STATISTICS*    SOURCE STATEMENTS =       15,PROGRAM SIZE =       776
     *STATISTICS*  NO DIAGNOSTICS GENERATED
```

```
FORTRAN IV G LEVEL  21              SING              DATE = 77070        16/50/31              PAGE 0001

 0001                 SUBROUTINF SING (IWHY)
 0002              11 FORMAT(54H0MATRIX WITH ZERO ROW IN DECOMPOSE,                    )
 0003              12 FORMAT(54H0SINGULAR MATRIX IN DECOMPOSE.  ZERO DIVIDF IN SOLVE.  )
 0004              13 FORMAT(54H0NO CONVERGENCE IN IMPRUV. MATRIX IS NEARLY SINGULAR.  )
 0005                 NOUT=6
            C         NOUT = STANDARD OUTPUT UNIT
 0006                 GO TO (1,2,3),IWHY
 0007               1 WRITE (NOUT,11)
 0008                 GO TO 10
 0009               2 WRITE (NOUT,12)
 0010                 GO TO 10
 0011               3 WRITE (NOUT,13)
 0012              10 RETURN
 0013                 END
```

```
FORTRAN IV G LEVEL  21                SING              DATE = 77070        16/50/31           PAGE 0002

                                     SUBPROGRAMS CALLED
SYMBOL    LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION
IBCOM#        B0

                                     SCALAR MAP
SYMBOL    LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION
NOUT          B4         IWHY          B8

                                     FORMAT STATEMENT MAP
SYMBOL    LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION       SYMBOL    LOCATION
    11        BC             12        F6             13       130

   *OPTIONS IN EFFECT*  ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
   *OPTIONS IN EFFECT*  NAME = SING    , LINECNT =       59
   *STATISTICS*    SOURCE STATEMENTS =        13,PROGRAM SIZE =      628
   *STATISTICS*  NO DIAGNOSTICS GENERATED
```

```
FORTRAN IV G LEVEL  21                SOLVE             DATE = 77070        16/50/31            PAGE 0001

 0001                 SUBROUTINE SOLVE (NN, UL, B, X)
 0002                 IMPLICIT REAL*8 (A-H,O-Z)
 0003                 DIMENSION UL(20,20), B(20), X(20), IPS(20)
 0004                 COMMON IPS
 0005                 N = NN
 0006                 NP1 = N+1
                C
 0007                 IP = IPS(1)
 0008                 X(1) = B(IP)
 0009                 DO 2 I = 2,N
 0010                 IP = IPS(I)
 0011                 IM1 = I-1
 0012                 SUM = 0.0
 0013                 DO 1 J = 1,IM1
 0014               1 SUM = SUM + UL(IP,J)*X(J)
 0015               2 X(I) = B(IP) - SUM
                C
 0016                 IP = IPS(N)
 0017                 X(N) = X(N)/UL(IP,N)
 0018                 DO 4 IBACK = 2,N
 0019                 I = NP1-IBACK
                C     I GOES (N-1),....,1
 0020                 IP = IPS(I)
 0021                 IP1 = I+1
 0022                 SUM = 0.0
 0023                 DO 3 J = IP1,N
 0024               3 SUM = SUM + UL(IP,J)*X(J)
 0025               4 X(I) = (X(I)-SUM)/UL(IP,I)
 0026                 RETURN
 0027                 END
```

```
   FORTRAN IV G LEVEL  21                  SOLVE              DATE = 77070         16/50/31            PAGE 0002

                                       COMMON BLOCK /          / MAP SIZE      50
  SYMBOL      LOCATION       SYMBOL     LOCATION       SYMBOL     LOCATION       SYMBOL     LOCATION       SYMBOL     LOCATION
  IPS               0

                                       SCALAR MAP
  SYMBOL      LOCATION       SYMBOL     LOCATION       SYMBOL     LOCATION       SYMBOL     LOCATION       SYMBOL     LOCATION
  SUM              A8        N                B0       NN               B4       NP1              B8       IP               BC
  I                C0        IM1              C4       J                C8       IBACK            CC       IP1              D0

                                       ARRAY MAP
  SYMBOL      LOCATION       SYMBOL     LOCATION       SYMBOL     LOCATION       SYMBOL     LOCATION       SYMBOL     LOCATION
  UL               D4        B                D8       X                DC

     *OPTIONS IN EFFECT*  ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
     *OPTIONS IN EFFECT*  NAME = SOLVE    , LINECNT =       59
     *STATISTICS*    SOURCE STATEMENTS =       27,PROGRAM SIZE =     1012
     *STATISTICS*  NO DIAGNOSTICS GENERATED
```

```
FORTRAN IV G LEVEL  21              RANK              DATE = 77070          16/50/31              PAGE 0001

              SUBROUTINE RANK(R,IC)
              DIMENSION R(1)
            2 IFLAG=0
              I1=IC-1
              DO 19 I=1,I1
              IF(R(I).LE.R(I+1))GO TO 19
              TEMP=R(I)
              R(I)=R(I+1)
              R(I+1)=TEMP
              IFLAG= 1
           19 CONTINUE
              IF(IFLAG.NE.0) GO TO 2
              RETURN
              END
```

```
F44-LEVEL LINKAGE EDITOR OPTIONS SPECIFIED XREF,LET,LIST
          DEFAULT OPTION(S) USED -  SIZE=(102400,49152)

                                             CROSS REFERENCE TABLE

   CONTROL SECTION                      ENTRY

     NAME      ORIGIN  LENGTH             NAME    LOCATION     NAME    LOCATION     NAME    LOCATION     NAME    LOCATION
   MAIN            00     1BC
   CALIB          1C0     E8C
   COEF          1050    54D4
   MEAN          6528     2C0
   HMAT          67E8     34A
   LINEAR        6B38    1CEA
   DECOMP        8828     65E
   EXPAND        8E88     308
   SING          9190     274
   SOLVE         9408     3F4
   RANK          9800     1D0
   IHCFRXPI*     99D0     141
                                        FRXPI#     99D0
   IHCECOMH*     9B18     F61
                                        IBCOM#     9B1A     FDIOCS#     9BD4     INTSWTCH    AA5E
   IHCCOMH2*     AA80     65D
                                        SEQDASD    ADF8
   IHCSSORT*     B0E0     145
                                        SQRT       B0E0
   IHCFCVTH*     B228    11B5
                                        ADCON#     B228     FCVAOUTP    B2D2     FCVLOUTP    B362     FCVZOUTP    B4BA
                                        FCVIOUTP   B86E     FCVEOUTP    BD70     FCVCOUTP    BF8A     INT6SWCH    C273
   IHCEFNTH*     C3E0     542
                                        ARITH#     C3E0     ADJSWTCH    C77C
   IHCEFIOS*     C928     F28
                                        FIOCS#     C928     FIOCSBEP    C92E
   IHCFIOS2*     D850     52E
   IHCERRM *     DD80     5DE
                                        ERRMON     DD80     IHCERRE     DD98
   IHCUOPT *     E360     300
   IHCETRCH*     E660     28E
                                        IHCTRCH    E660     ERRTRA      E668
   IHCUATBL*     E8F0     638
   INDIPT        EF28      10
   CALWRK        EF38     870
   CALIBR        F7A8     190
  SBLANKCOM      F938      50

   LOCATION  REFERS TO SYMBOL  IN CONTROL SECTION            LOCATION  REFERS TO SYMBOL  IN CONTROL SECTION
        78          INDIPT         INDIPT                          98        IBCOM#          IHCECOMH
        9C          CALIB          CALIB                          BDC        CALWRK          CALWRK
```

```
FORTRAN IV G LEVEL  21                RANK                DATE = 77070          16/50/31           PAGE 0002

                                 SCALAR MAP
SYMBOL     LOCATION       SYMBOL    LOCATION        SYMBOL     LOCATION        SYMBOL     LOCATION        SYMBOL     LOCATION
IFLAG           AC        I1              B0        IC               B4        I                B8        TEMP             BC

                                 ARRAY MAP
SYMBOL     LOCATION       SYMBOL    LOCATION        SYMBOL     LOCATION        SYMBOL     LOCATION        SYMBOL     LOCATION
R               C0

   *OPTIONS IN EFFECT*  ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
   *OPTIONS IN EFFECT*  NAME = RANK    , LINECNT =       59
   *STATISTICS*    SOURCE STATEMENTS =       14,PROGRAM SIZE =       464
   *STATISTICS*  NO DIAGNOSTICS GENERATED

   *STATISTICS*  NO DIAGNOSTICS THIS STEP
```

```
LOCATION  REFERS TO SYMBOL  IN CONTROL SECTION      LOCATION  REFERS TO SYMBOL  IN CONTROL SECTION

    BD4          CALWRK           CALWRK                BD0          CALIBR           CALIBR
    238          CALWRK           CALWRK                23C          CALIBR           CALIBR
    240          INDIPT           INDIPT                290          CALWRK           CALWRK
    294          CALWRK           CALWRK                298          CALWRK           CALWRK
    2A8          IBCOM#           IHCECOMH              28C          COEF             COEF
    BE0          CALWRK           CALWRK               10C8          INDIPT           INDIPT
   10CC          CALIBR           CALIBR               1144          HMAT             HMAT
   1148          LINEAR           LINEAR               114C          IBCOM#           IHCECOMH
   1150          RANK             RANK                 1154          MEAN             MEAN
   1158          SQRT             IHCSSQRT             5E94          CALIBR           CALIBR
   65C8          SQRT             IHCSSQRT             6860          INDIPT           INDIPT
   68A4          EXPAND           EXPAND               68E0          DECOMP           DECOMP
   6BE4          SOLVE            SOLVE                8A88
   88A0                                                8944          SING             SING
   8A90                                                8F3C          FRXPI#           IHCFRXPI
   9240          IBCOM#           IHCECOMH             9480
   9510                                                9AA0          IBCOM#           IHCECOMH
   9AA4          IHCERRM          IHCERRM              9BD4          SEQDASD          IHCCOMH2
   A964          ADCON#           IHCFCVTH             A95C          FIOCS#           IHCEFIOS
   A968          ARITH#           IHCEFNTH             A988          ADJSWTCH         IHCEFNTH
   A984          IHCUOPT          IHCUOPT              A96C          FCVEOUTP         IHCFCVTH
   A970          FCVLOUTP         IHCFCVTH             A974          FCVIOUTP         IHCFCVTH
   A978          FCVCOUTP         IHCFCVTH             A97C          FCVAOUTP         IHCFCVTH
   A980          FCVZOUTP         IHCFCVTH             A910          IHCERRE          IHCERRM
   A93C          IHCCOMH2         IHCCOMH2             A940          IHCERRM          IHCERRM
   A914          IHCCOMH2         IHCCOMH2             A918          IHCCOMH2         IHCCOMH2
   A91C          IHCCOMH2         IHCCOMH2             A920          IHCCOMH2         IHCCOMH2
   AD10          IHCECOMH         IHCECOMH             AD20          IHCECOMH         IHCECOMH
   AACA          IHCERRM          IHCERRM              AAC4          IBCOM#           IHCECOMH
   AF30          IHCECOMH         IHCECOMH             AF4D          IHCECOMH         IHCECOMH
   AF5D          IHCECOMH         IHCECOMH             B1B0          IBCOM#           IHCECOMH
   B108          IHCERRM          IHCERRM              C234          IBCOM#           IHCECOMH
   C230          IHCERRM          IHCERRM              C7CC          IBCOM#           IHCECOMH
   C7D0          INTSWTCH         IHCECOMH             C778          INT6SWCH         IHCFCVTH
   C774          IHCUOPT          IHCUOPT              C7D8          ADCON#           IHCFCVTH
   C7D4          FIOCS#           IHCEFIOS             C844          IHCERRM          IHCERRM
   CA90          IHCERRM          IHCERRM              CA94          IHCFIOS2         IHCFIOS2
   D6A0          IHCUATBL         IHCUATBL             D6AC          IBCOM#           IHCECOMH
   D6C1          IHCFIOS2         IHCFIOS2             D6D8          IHCFIOS2         IHCFIOS2
   D849          IHCFIOS2         IHCFIOS2             E34C          IHCUOPT          IHCUOPT
   E350          IBCOM#           IHCECOMH             E354          IHCTRCH          IHCETRCH
   E358          FIOCSBEP         IHCEFIOS             E7D4          IBCOM#           IHCECOMH
   E7DA          ADCON#           IHCFCVTH             E7DC          FIOCSBEP         IHCEFIOS

 ENTRY ADDRESS       00
 TOTAL LENGTH      F988

****MAIN       DOES NOT EXIST BUT HAS BEEN ADDED TO DATA SET
```

```
NSECTS=    1

SECTOR NUMBER=    1 REF POINT NUMBER=  704 NUMBER OF CALIBRATION POINTS=   19

COORDINATES OF SECTOR BOUNDARY POINTS
     0.0        0.0    99999.000 99999.000

INPUT DATA FROM CODING FORMS
   700    211.9400    312.2068 19542.0000   6188.0000      1.0000      1.0000
   701    220.0700    319.6899 19149.0000   3751.0000      1.0000      1.0000
   703    217.8980    321.1628 21164.0000   2642.0000      1.0000      1.0000
   704    221.1320    312.9170 14607.0000   6237.0000      1.0000      1.0000
   705    225.1830    315.1050 13528.0000   4024.0000      1.0000      1.0000
   706    222.8900    316.0889 15412.0000   4596.0000      1.0000      1.0000
   707    226.0930    318.8750 15069.0000   2661.0000      1.0000      1.0000
   710    228.4250    318.3499 13591.0000   2077.0000      1.0000      1.0000
   376    230.0120    319.3359 13120.0000   1210.0000      1.0000      1.0000
   400    228.9800    318.4900 13120.0000   1660.0000      1.0000      1.0000
   403    227.9900    317.4690 13145.0000   2660.0000      1.0000      1.0000
   405    227.2230    316.4768 13120.0000   3035.0000      1.0000      1.0000
   407    225.5590    315.0469 13130.0000   4030.0000      1.0000      1.0000
   410    227.7460    317.7729 13590.0000   2705.0000      1.0000      1.0000
   412    229.2810    319.4058 13580.0000   1685.0000      1.0000      1.0000
   415    230.7460    320.8550 13575.0000    695.0000      1.0000      1.0000
   417    231.4730    321.5779 13570.0000    370.0000      1.0000      1.0000
   420    232.2150    322.3899 13570.0000     25.0000      1.0000      1.0000
   434    228.0980    319.0000 14000.0000   2045.0000      1.0000      1.0000

CALIBRATION POINT ERROR MAP
          XC          X          ERRX        YC          Y          ERRY


  700  0.1955E 05  0.1954E 05  0.7953E 01  0.6219E 04  0.6188E 04  0.3098E 02  0.3198E 02
  701  0.1911E 05  0.1915E 05 -0.3873E 02  0.3540E 04  0.3751E 04 -0.2109E 03  0.2144E 03
  703  0.2118E 05  0.2116E 05  0.1237E 02  0.2726E 04  0.2642E 04  0.8367E 02  0.8458E 02
  704  0.1461E 05  0.1461E 05  0.0         0.6237E 04  0.6237E 04  0.0         0.0
  705  0.1348E 05  0.1353E 05 -0.4341E 02  0.4203E 04  0.4024E 04  0.1787E 03  0.1839E 03
  706  0.1541E 05  0.1541E 05 -0.3979E 00  0.4557E 04  0.4596E 04 -0.3942E 02  0.3942E 02
  707  0.1515E 05  0.1507E 05  0.7737E 02  0.2939E 04  0.2661E 04  0.2783E 03  0.2888E 03
  710  0.1346E 05  0.1359E 05 -0.1282E 03  0.2104E 04  0.2077E 04  0.2737E 02  0.1311E 03
  376  0.1310E 05  0.1312E 05 -0.2010E 02  0.1204E 04  0.1210E 04 -0.5598E 01  0.2087E 02
  400  0.1322E 05  0.1312E 05  0.9558E 02  0.1818E 04  0.1660E 04  0.1575E 03  0.1843E 03
  403  0.1320E 05  0.1315E 05  0.5883E 02  0.2446E 04  0.2660E 04 -0.2136E 03  0.2215E 03
  405  0.1308E 05  0.1312E 05 -0.4312E 02  0.2995E 04  0.3035E 04 -0.4017E 02  0.5893E 02
  407  0.1323E 05  0.1313E 05  0.9706E 02  0.4075E 04  0.4030E 04  0.4475E 02  0.1069E 03
  410  0.1353E 05  0.1359E 05 -0.6283E 02  0.2506E 04  0.2705E 04 -0.1992E 03  0.2088E 03
  412  0.1357E 05  0.1358E 05 -0.5123E 01  0.1573E 04  0.1685E 04 -0.1125E 03  0.1126E 03
  415  0.1356E 05  0.1358E 05 -0.1748E 02  0.7487E 03  0.6950E 03  0.5368E 02  0.5645E 02
  417  0.1355E 05  0.1357E 05 -0.1851E 02  0.3574E 03  0.3700E 03 -0.1259E 02  0.2238E 02
  420  0.1359E 05  0.1357E 05  0.1924E 02 -0.2499E 02  0.2500E 02 -0.4999E 02  0.5556E 02
  434  0.1404E 05  0.1400E 05  0.3750E 02  0.2163E 04  0.2045E 04  0.1183E 03  0.1241E 03

RANK ORDER STATISTICS OF CALIBRATION POINT RADIAL ERRORS
   1  0.0
   2  0.2087E 02
   3  0.2238E 02
   4  0.3198E 02
   5  0.3942E 02
```

```
     6  0.5356E 02
     7  0.5645E 02
     8  0.5893E 02
     9  0.8458E 02
    10  0.1069E 03
    11  0.1126E 03
    12  0.1241E 03
    13  0.1311E 03
    14  0.1839E 03
    15  0.1843E 03
    16  0.2088E 03
    17  0.2144E 03
    18  0.2215E 03
    19  0.2888E 03

MEAN RADIAL ERROR=   0.11287E 03 RADIAL ERROR STANDARD DEVIATION=   0.81001E 02

X COEFFS FOR SECTOR    1   -590.4443   580.9658    -1.0128    2.1800    -0.9111

Y COEFFS FOR SECTOR    1   -204.8187  -475.8906   -28.7610   28.4008    11.8919
```

```
REMOTE        END JOB 261   CALIB261 CUST=06689551003     I.D.=ESMS0035 TERM.=9013 DATE=FRI. 11 MAR 1977          TIME=17.08.16

REMOTE        END JOB 261   CALIB261 CUST=06689551003     I.D.=ESMS0035 TERM.=9013 DATE=FRI. 11 MAR 1977          TIME=17.08.16

REMOTE        END JOB 261   CALIB261 CUST=06689551003     I.D.=ESMS0035 TERM.=9013 DATE=FRI. 11 MAR 1977          TIME=17.08.16

REMOTE        END JOB 261   CALIB261 CUST=06689551003     I.D.=ESMS0035 TERM.=9013 DATE=FRI. 11 MAR 1977          TIME=17.08.16

REMOTE        END JOB 261   CALIB261 CUST=06689551003     I.D.=ESMS0035 TERM.=9013 DATE=FRI. 11 MAR 1977          TIME=17.08.16

REMOTE        END JOB 261   CALIB261 CUST=06689551003     I.D.=ESMS0035 TERM.=9013 DATE=FRI. 11 MAR 1977          TIME=17.08.16

REMOTE        END JOB 261   CALIB261 CUST=06689551003     I.D.=ESMS0035 TERM.=9013 DATE=FRI. 11 MAR 1977          TIME=17.08.16

REMOTE        END JOB 261   CALIB261 CUST=06689551003     I.D.=ESMS0035 TERM.=9013 DATE=FRI. 11 MAR 1977          TIME=17.08.16

REMOTE        END JOB 261   CALIB261 CUST=06689551003     I.D.=ESMS0035 TERM.=9013 DATE=FRI. 11 MAR 1977          TIME=17.08.16

REMOTE        END JOB 261   CALIB261 CUST=06689551003     I.D.=ESMS0035 TERM.=9013 DATE=FRI. 11 MAR 1977          TIME=17.08.16

REMOTE        END JOB 261   CALIB261 CUST=06689551003     I.D.=ESMS0035 TERM.=9013 DATE=FRI. 11 MAR 1977          TIME=17.08.16

REMOTE        END JOB 261   CALIB261 CUST=06689551003     I.D.=ESMS0035 TERM.=9013 DATE=FRI. 11 MAR 1977          TIME=17.08.16

REMOTE        END JOB 261   CALIB261 CUST=06689551003     I.D.=ESMS0035 TERM.=9013 DATE=FRI. 11 MAR 1977          TIME=17.08.16

REMOTE        END JOB 261   CALIB261 CUST=06689551003     I.D.=ESMS0035 TERM.=9013 DATE=FRI. 11 MAR 1977          TIME=17.08.16

REMOTE        END JOB 261   CALIB261 CUST=06689551003     I.D.=ESMS0035 TERM.=9013 DATE=FRI. 11 MAR 1977          TIME=17.08.16

REMOTE        END JOB 261   CALIB261 CUST=06689551003     I.D.=ESMS0035 TERM.=9013 DATE=FRI. 11 MAR 1977          TIME=17.08.16

REMOTE        END JOB 261   CALIB261 CUST=06689551003     I.D.=ESMS0035 TERM.=9013 DATE=FRI. 11 MAR 1977          TIME=17.08.16

REMOTE        END JOB 261   CALIB261 CUST=06689551003     I.D.=ESMS0035 TERM.=9013 DATE=FRI. 11 MAR 1977          TIME=17.08.16

REMOTE        END JOB 261   CALIB261 CUST=06689551003     I.D.=ESMS0035 TERM.=9013 DATE=FRI. 11 MAR 1977          TIME=17.08.16

REMOTE        END JOB 261   CALIB261 CUST=06689551003     I.D.=ESMS0035 TERM.=9013 DATE=FRI. 11 MAR 1977          TIME=17.08.16

REMOTE        END JOB 261   CALIB261 CUST=06689551003     I.D.=ESMS0035 TERM.=9013 DATE=FRI. 11 MAR 1977          TIME=17.08.16
REMOTE        END JOB 261   CALIB261 CUST=06689551003     I.D.=ESMS003' TERM.=9013 DATE=FRI. 11 MAR 1977          TIME=17.08.16
```

# APPENDIX B - SPECIAL CASE TEST DATA SHEETS

The special case data sheets are divided into five sections:

B. 1 Augmentor Coverage - General
B. 2 Augmentor Coverage In Traffic
B. 3 Augmentor Interference
B. 4 Augmentor Radio Interference
B. 5 Augmentor Antenna Pattern.

B. 1 AUGMENTOR COVERAGE - GENERAL

## SPECIAL CASE TEST

## DATA SHEET

(1) Date 2-6-76 (2) Time 1335

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 500'

(4) Distance from Augmentor detection Pt. to Aug. 37' (R.T. ≃10)

(5) Distance from loss of Aug. Detection Pt. to Aug. 85' (R.T. ≃10)

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No ____

(7) Run Number 30101 (8) Vehicle Speed ~~5~~ 10 MPH

(9) Augmentor Elevation 15 (Ft)

(10) Remarks: ____

(11) Test Conductor Barry E. Br

(12) Assistant [illegible]

(13) Witnesses Joseph [illegible] TSC

## SPECIAL CASE TEST

## DATA SHEET

(1) Date 2-6-77 (2) Time 1340

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 500'

(4) Distance from Augmentor detection Pt. to Aug. 35' (R.T. ≈10)

(5) Distance from loss of Aug. Detection Pt. to Aug. 90' (R.T. ≈10)

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No ____

(7) Run Number 30102 (8) Vehicle Speed ~~5~~ 10 MPH

(9) Augmentor Elevation 15 (Ft)

(10) Remarks: ____

(11) Test Conductor Barry E. Br

(12) Assistant ____

(13) Witnesses Joseph P. Hartley SC

SPECIAL CASE TEST

DATA SHEET

(1) Date 2-6-77 (2) Time 1340

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 5001'

(4) Distance from Augmentor detection Pt. to Aug. 23' (+R.T. ≈ 20')

(5) Distance from loss of Aug. Detection Pt. to Aug. 108' (-R.T. ≈ 20')

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No ____

(7) Run Number 30103 (8) Vehicle Speed 15 MPH

(9) Augmentor Elevation 15 (Ft)

(10) Remarks:

(11) Test Conductor Barry E. B

(12) Assistant

(13) Witnesses Joseph [illegible] TSC

## SPECIAL CASE TEST

## DATA SHEET

(1) Date 2-6-77 (2) Time 1345

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 500'

(4) Distance from Augmentor detection Pt. to Aug. 21' (+R.T. ≈ 20')

(5) Distance from loss of Aug. Detection Pt. to Aug. 110' (-R.T. ≈ 20')

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No ______

(7) Run Number 30104 (8) Vehicle Speed 15 MPH

(9) Augmentor Elevation 15 (Ft)

(10) Remarks:

(11) Test Conductor

(12) Assistant

(13) Witnesses

## SPECIAL CASE TEST

## DATA SHEET

(1) Date 2-6-77 (2) Time 1352

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 1000'

(4) Distance from Augmentor detection Pt. to Aug. -60+(R.T. 88')

(5) Distance from loss of Aug. Detection Pt. to Aug. 160-(R.T. 88)

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No _____

(7) Run Number 30110 (8) Vehicle Speed 55 MPH

(9) Augmentor Elevation 15 (Ft)

(10) Remarks: _____

(11) Test Conductor Barry E. Br

(12) Assistant _____

(13) Witnesses Joseph [illegible] Jr

SPECIAL CASE TEST

DATA SHEET

(1) Date 2-6-77 (2) Time 1352

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 1000'

(4) Distance from Augmentor detection Pt. to Aug. -50' + (R.T. 88')

(5) Distance from loss of Aug. Detection Pt. to Aug. 150' - (R.T. 88')

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No

(7) Run Number 30107 (8) Vehicle Speed 55 MPH

(9) Augmentor Elevation 15 (Ft)

(10) Remarks:

(11) Test Conductor Barry E. Br

(12) Assistant

(13) Witnesses Joseph [illegible] TSC

## SPECIAL CASE TEST

## DATA SHEET

(1) Date 2-6-77 (2) Time 1348

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 1000'

(4) Distance from Augmentor detection Pt. to Aug. 5'+ (R.T. 44')

(5) Distance from loss of Aug. Detection Pt. to Aug. 95 - (R.T. 44')

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No ______

(7) Run Number 30106 (8) Vehicle Speed 35 MPH

(9) Augmentor Elevation 15 (Ft)

(10) Remarks: ______

(11) Test Conductor Barry E. B

(12) Assistant

(13) Witnesses TSC

## SPECIAL CASE TEST

## DATA SHEET

(1) Date 2-6-77 (2) Time 1343

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 1000'

(4) Distance from Augmentor detection Pt. to Aug. 10' +(R.T. 44')

(5) Distance from loss of Aug. Detection Pt. to Aug. 91' – (R.T. 44')

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No ______

(7) Run Number 30105 (8) Vehicle Speed 35 MPH

(9) Augmentor Elevation 15 (Ft)

(10) Remarks: ______

(11) Test Conductor Barry E. Br

(12) Assistant

(13) Witnesses TSC

## SPECIAL CASE TEST

## DATA SHEET

(1) Date ________ (2) Time ________

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor

(4) Distance from Augmentor detection Pt. to Aug.

(5) Distance from loss of Aug. Detection Pt. to Aug.

(6) Augmentor ID No. ________ Detected correctly Yes ____ No ____

(7) Run Number 30111 (8) Vehicle Speed ~~85~~ 75 MPH

(9) Augmentor Elevation 15 (Ft)

(10) Remarks:

ELEVATION & RANGE TOO
RESULTING
LOW FOR MEASUREMENT
AT THIS SPEED. (DETECTION & LOSS OCCURRED
SIMULTANEOUSLY JUST AFTER
PASSING)

(11) Test Conductor Barry E. Be

(12) Assistant

(13) Witnesses TSC

SPECIAL CASE TEST

DATA SHEET

(1) Date________________ (2) Time______________

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor

(4) Distance from Augmentor detection Pt. to Aug.

(5) Distance from loss of Aug. Detection Pt. to Aug.

(6) Augmentor ID No. ________________ Detected correctly Yes_____ No_____

(7) Run Number 30112 (8) Vehicle Speed ~~85~~ 75 MPH

(9) Augmentor Elevation 15 (Ft)

(10) Remarks:

Same as # 30111

(11) Test Conductor

(12) Assistant

(13) Witnesses

## SPECIAL CASE TEST

## DATA SHEET

(1) Date 2-6-77 (2) Time 1325

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 1000'

(4) Distance from Augmentor detection Pt. to Aug. 32' (+R.T. 10')

(5) Distance from loss of Aug. Detection Pt. to Aug. 95' (-R.T. 10')

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No ____

(7) Run Number 30201 (8) Vehicle Speed ~~5~~ 10 MPH

(9) Augmentor Elevation 10 (Ft)

(10) Remarks: ____

(11) Test Conductor Barry E. B

(12) Assistant

(13) Witnesses [illegible] JSC

## SPECIAL CASE TEST

## DATA SHEET

(1) Date 2-6-77 (2) Time 1320

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 1000'

(4) Distance from Augmentor detection Pt. to Aug. 24' (+R.T. 10')

(5) Distance from loss of Aug. Detection Pt. to Aug. 101' (-R.T. 10')

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No ____

(7) Run Number 30202 (8) Vehicle Speed ~~5~~ 10 MPH

(9) Augmentor Elevation 10 (Ft)

(10) Remarks: ____

(11) Test Conductor Barry E. Br

(12) Assistant

(13) Witnesses

## SPECIAL CASE TEST

## DATA SHEET

(1) Date 2-6-77 (2) Time 1240

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 1000'

(4) Distance from Augmentor detection Pt. to Aug. 297' (+R.T. 10')

(5) Distance from loss of Aug. Detection Pt. to Aug. 378' (-R.T. 10')

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No

(7) Run Number 30203 (8) Vehicle Speed ~~8~~ 10 MPH

(9) Augmentor Elevation 20 (Ft)

(10) Remarks:

(11) Test Conductor Barry E. Br

(12) Assistant

(13) Witnesses

SPECIAL CASE TEST

DATA SHEET

(1) Date 2-6-77 (2) Time 1235

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 1000'

(4) Distance from Augmentor detection Pt. to Aug. 254' (+R.T. 10')

(5) Distance from loss of Aug. Detection Pt. to Aug. 389' (-R.T. 10')

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No ____

(7) Run Number 30204 (8) Vehicle Speed ~~8~~ 10 MPH

(9) Augmentor Elevation 20 (Ft)

(10) Remarks: ____

(11) Test Conductor Barry E. Br

(12) Assistant

(13) Witnesses Joseph TSC

## SPECIAL CASE TEST

## DATA SHEET

(1) Date 2-6-77 (2) Time 1310

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 1000'

(4) Distance from Augmentor detection Pt. to Aug. 8' (+R.T. 44')

(5) Distance from loss of Aug. Detection Pt. to Aug. 100' (-R.T. 44')

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No

(7) Run Number 30207/[redacted] (8) Vehicle Speed 35 MPH

(9) Augmentor Elevation 10 (Ft)

(10) Remarks:

(11) Test Conductor Barry E. Br

(12) Assistant

(13) Witnesses

## SPECIAL CASE TEST

## DATA SHEET

(1) Date 2-6-77 (2) Time 1315

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 1000'

(4) Distance from Augmentor detection Pt. to Aug. 22' (+R.T. 44')

(5) Distance from loss of Aug. Detection Pt. to Aug. 121' (-R.T. 44')

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No ____

(7) Run Number 30210/[redacted] (8) Vehicle Speed 35 MPH

(9) Augmentor Elevation 10 (Ft)

(10) Remarks:

(11) Test Conductor Barry E. Br

(12) Assistant

(13) Witnesses Joseph Hartley TSC

SPECIAL CASE TEST

DATA SHEET

(1) Date 2-6-77 (2) Time 1230

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 1430'

(4) Distance from Augmentor detection Pt. to Aug. 214' (+R.T. 44')

(5) Distance from loss of Aug. Detection Pt. to Aug. 444 (-R.T. 44')

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No ____

(7) Run Number 30211 (8) Vehicle Speed 35 MPH

(9) Augmentor Elevation 20 (Ft)

(10) Remarks:

(11) Test Conductor

(12) Assistant

(13) Witnesses

SPECIAL CASE TEST

DATA SHEET

(1) Date 2-6-77 (2) Time 1225

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 1430'

(4) Distance from Augmentor detection Pt. to Aug. 195' (+R.T. 44')

(5) Distance from loss of Aug. Detection Pt. to Aug. 525' (-R.T. 44')

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No ____

(7) Run Number 30212 (8) Vehicle Speed 35 MPH

(9) Augmentor Elevation 20 (Ft)

(10) Remarks: ____

(11) Test Conductor Barry E. B[illegible]

(12) Assistant [illegible]

(13) Witnesses Joseph [illegible] TSC

## SPECIAL CASE TEST

## DATA SHEET

(1) Date 2-6-76 (2) Time 1325

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 1000'

(4) Distance from Augmentor detection Pt. to Aug. -37 (+R.T. 88')

(5) Distance from loss of Aug. Detection Pt. to Aug. 181 (-R.T. 88')

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No ____

(7) Run Number 30216 / [redacted] (8) Vehicle Speed 55 MPH

(9) Augmentor Elevation 10 (Ft)

(10) Remarks:

(11) Test Conductor Bary E. Br

(12) Assistant

(13) Witnesses TSC

## SPECIAL CASE TEST

## DATA SHEET

(1) Date 2-6-77 (2) Time 1330

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor

(4) Distance from Augmentor detection Pt. to Aug. -72 (+R.T. 88')

(5) Distance from loss of Aug. Detection Pt. to Aug. 165 (-R.T. 88')

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No ____

(7) Run Number 30215 / [redacted] (8) Vehicle Speed 55 MPH

(9) Augmentor Elevation 10 (Ft)

(10) Remarks:

(11) Test Conductor

(12) Assistant

(13) Witnesses

## SPECIAL CASE TEST

## DATA SHEET

(1) Date 2-6-77 (2) Time 1220

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 1430'

(4) Distance from Augmentor detection Pt. to Aug. 161' (+R.T.-88')

(5) Distance from loss of Aug. Detection Pt. to Aug. 624' (-R.T. 88')

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No ____

(7) Run Number 30217 (8) Vehicle Speed 55 MPH

(9) Augmentor Elevation 20 (Ft)

(10) Remarks: ____

(11) Test Conductor Barry F. Br

(12) Assistant ____

(13) Witnesses ____

## SPECIAL CASE TEST

## DATA SHEET

(1) Date 2-6-77 (2) Time 1215

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 1430'

(4) Distance from Augmentor detection Pt. to Aug. 142' (+R.T. 88')

(5) Distance from loss of Aug. Detection Pt. to Aug. 557' (-R.T. 88')

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No

(7) Run Number 30220 (8) Vehicle Speed 55 MPH

(9) Augmentor Elevation 20 (Ft)

(10) Remarks:

(11) Test Conductor Barry E. B

(12) Assistant

(13) Witnesses Joseph Herlihy TSC

SPECIAL CASE TEST

DATA SHEET

(1) Date 2-6-77 (2) Time 1310

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 1000'

(4) Distance from Augmentor detection Pt. to Aug.

(5) Distance from loss of Aug. Detection Pt. to Aug.

(6) Augmentor ID No. 61 Detected correctly Yes ____ No ____

(7) Run Number 30223/[redacted] (8) Vehicle Speed ~~85~~ 75 MPH

(9) Augmentor Elevation 10 (Ft)

(10) Remarks: ELEVATION & RESULTING RANGE TOO SHORT FOR MEASUREMENT (- DETECTION & LOSS SIMULTANEOUS) JUST ~~AFTER~~ Augmentor

(11) Test Conductor Barry E. B

(12) Assistant

(13) Witnesses TSC

## SPECIAL CASE TEST

## DATA SHEET

(1) Date 2-6-77 (2) Time 1250

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 1430'

(4) Distance from Augmentor detection Pt. to Aug. -5' (+R.T. 100')

(5) Distance from loss of Aug. Detection Pt. to Aug. 20' (-R.T. 100')

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No ____

(7) Run Number 30224/[redacted] (8) Vehicle Speed ~~85~~ 75 MPH

(9) Augmentor Elevation 10 (Ft)

(10) Remarks: ELEVATION & RANGE TOO LOW FOR MEASUREMENT (DETECTION & LOSS SIMULTANEOUS JUST AFTER Augmentor)

(11) Test Conductor Barry E. B

(12) Assistant

(13) Witnesses Joseph TSC

SPECIAL CASE TEST

DATA SHEET

(1) Date 2-6-77 (2) Time 1210

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 1430'

(4) Distance from Augmentor detection Pt. to Aug. 169' (+ R.T. 100')

(5) Distance from loss of Aug. Detection Pt. to Aug. 619' (- R.T. 100')

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No ____

(7) Run Number 30225 (8) Vehicle Speed ~~85~~ 75 MPH

(9) Augmentor Elevation 20 (Ft)

(10) Remarks: ____

(11) Test Conductor Barry E. B

(12) Assistant

(13) Witnesses Joseph B. Herlihy TSC

## SPECIAL CASE TEST

## DATA SHEET

(1) Date 2-6-76 (2) Time 1208

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 1430'

(4) Distance from Augmentor detection Pt. to Aug. 32' (+R.T. 100')

(5) Distance from loss of Aug. Detection Pt. to Aug. 588' (-R.T. 100')

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No

(7) Run Number 30226 (8) Vehicle Speed ~~85~~ 75 MPH

(9) Augmentor Elevation 20 (Ft)

(10) Remarks:

(11) Test Conductor Barry F. B

(12) Assistant

(13) Witnesses Joseph P. Herlihy TSC

## SPECIAL CASE TEST

## DATA SHEET

(1) Date 2-6-77 (2) Time 1150

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 1000'

(4) Distance from Augmentor detection Pt. to Aug. 368' (+R.T. 10')

(5) Distance from loss of Aug. Detection Pt. to Aug. 391 (-R.T. 10')

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No ____

(7) Run Number 30206 (8) Vehicle Speed ~~5~~ 10 MPH

(9) Augmentor Elevation ~~40~~ 30 (Ft)

(10) Remarks: ____

(11) Test Conductor Barry F. B

(12) Assistant ____

(13) Witnesses TSC

SPECIAL CASE TEST

DATA SHEET

(1) Date 2-6-77 (2) Time 1145

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 1000'

(4) Distance from Augmentor detection Pt. to Aug. 361' (+R.T. 10')

(5) Distance from loss of Aug. Detection Pt. to Aug. 403' (-R.T. 10')

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No

(7) Run Number 30205 (8) Vehicle Speed ~~8~~ 10 MPH

(9) Augmentor Elevation ~~40~~ 30 (Ft)

(10) Remarks:

(11) Test Conductor Barry E. B

(12) Assistant

(13) Witnesses TSC

## SPECIAL CASE TEST

## DATA SHEET

(1) Date 2-6-77 (2) Time 1140

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 1430'

(4) Distance from Augmentor detection Pt. to Aug. 342' (+R.T. 44')

(5) Distance from loss of Aug. Detection Pt. to Aug. 452' (-R.T. 44')

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No

(7) Run Number 30214 (8) Vehicle Speed 35 MPH

(9) Augmentor Elevation ~~40~~ 30 (Ft)

(10) Remarks:

(11) Test Conductor Barry E. Br

(12) Assistant Joseph Frazier

(13) Witnesses GSC

## SPECIAL CASE TEST

## DATA SHEET

(1) Date 2-6-77 (2) Time 1135

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 1430'

(4) Distance from Augmentor detection Pt. to Aug. 326' +R.T. (44')

(5) Distance from loss of Aug. Detection Pt. to Aug. 462' -R.T. (44')

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No ______

(7) Run Number 30213 (8) Vehicle Speed 35 MPH

(9) Augmentor Elevation ~~40~~ 30 (Ft)

(10) Remarks: ______

(11) Test Conductor Barry E. B

(12) Assistant

(13) Witnesses TSC

## SPECIAL CASE TEST

## DATA SHEET

(1) Date 2-6-77 (2) Time 1130

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 1430'

(4) Distance from Augmentor detection Pt. to Aug. 217' +R.T. (88')

(5) Distance from loss of Aug. Detection Pt. to Aug. 497' -R.T. (88')

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No ____

(7) Run Number 30221 (8) Vehicle Speed 55 MPH

(9) Augmentor Elevation ~~40~~ 30 (Ft)

(10) Remarks:

(11) Test Conductor Barry E. B

(12) Assistant Jay W. Frazier

(13) Witnesses TSC

SPECIAL CASE TEST

DATA SHEET

(1) Date 2-6-77 (2) Time 1125

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 1430'

(4) Distance from Augmentor detection Pt. to Aug. 256' + R.T. (88')

(5) Distance from loss of Aug. Detection Pt. to Aug. 505' – R.T. (88')

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No ______

(7) Run Number 30222 (8) Vehicle Speed 55 MPH

(9) Augmentor Elevation ~~40~~ 30 (Ft)

(10) Remarks: ______

(11) Test Conductor Barry E. Br

(12) Assistant ______

(13) Witnesses TSC

SPECIAL CASE TEST

DATA SHEET

(1) Date 2-6-77 (2) Time 1120

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 1430'

(4) Distance from Augmentor detection Pt. to Aug. 202' [redacted] '(+ Reaction Time 88')

(5) Distance from loss of Aug. Detection Pt. to Aug. [redacted] 518' (- " 88')

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No ______

(7) Run Number 30227 (8) Vehicle Speed 75 MPH

(9) Augmentor Elevation 30 (Ft)

(10) Remarks: ______

(11) Test Conductor Barry E. Br

(12) Assistant ______

(13) Witnesses TSC

SPECIAL CASE TEST

DATA SHEET

(1) Date 2-6-77 (2) Time 1115

(2) Test Name: Augmentor Coverage

(3) Distance from Vehicle Start to Augmentor 1430'

(4) Distance from Augmentor detection Pt. to Aug. 190' + 1 SEC. REACTION (88')

(5) Distance from loss of Aug. Detection Pt. to Aug. 491'

(6) Augmentor ID No. 61 Detected correctly Yes ✓ No ____

(7) Run Number 30230 (8) Vehicle Speed ~~85~~ 75 MPH

(9) Augmentor Elevation ~~40~~ 30 (Ft)

(10) Remarks:

(11) Test Conductor Barry E. B

(12) Assistant

(13) Witnesses TSC

## B.2 AUGMENTOR COVERAGE IN TRAFFIC

### SPECIAL CASE TEST

### DATA SHEET

(1) Date FEB. 9, 1977 (2) Time 1035 EST

(2) Test Name: Augmentor Coverage vs Traffic Conditions

(3) Augmentor ID 61 FULL-LONG WHIP CONFIG. (4) 2nd Augmentor ID 63

(5) Augmentor Elevation * (SEE BELOW) feet

(6)

| *ELEVATION | Run No. | TEST # | Distance $d_1$ | Distance $d_2$ | Calculated Range, R $R = \sqrt{d_1^2 + d_2^2}$ | OBSTACLES | LOSS + $D_2$ |
|---|---|---|---|---|---|---|---|
| 10 | 1A | 30401 | 84 | 225 | 240 | -0- | 350 |
| 10 | 1B | | 72 | 195 | 208 | -0- | 350 |
| 15 | 2A | 30402 | 84 | 374 | 392 | TRUCK | 660 |
| 15 | 2B | | 72 | 265 | 275 | ← MAIL TRUCK | 650 |
| 20 | 3A | 30403 | 84 | 325 | 336 | TRUCK | 500 |
| | 3B | | 72 | 300 | 309 | -0- | 650 |
| 28 | 4A * | 30404 | 84 | 645 ** | **650 | -0- | 900 |
| | 4B * | | 72 | 685 ** | **689 | -0- | 1000 |
| 10 | 5A | 30405 | 84 | 200 | 217 | -0- | 400 |
| 10 | 5B | | 72 | 175 | 189 | -0- | 375 |
| 15 | 6A | 30406 | 84 | 285 | 297 | -0- | 575 |
| 15 | 6B | | 72 | 300 | 309 | 4 BUSSES | 550 |
| 20 | 7A | 30407 | 84 | 320 | 331 | -0- | 600 |
| | 7B | | 72 | 355 | 362 | -0- | 605 |
| 28 | 8A ** | 30410 | 84 | 650 ** | **655 | BUS | 875 |
| | 8B ** | | 72 | 690 ** | **694 | -0- | 1000 |

(7) Remarks ** BLOCK NOT LONG ENOUGH - AQUIRED I.D. PRIOR TO TURNING CORNER ON JFK DUE TO REFLECTION.

(8) Test Conductor

(9) Witnesses TSC

TSC

B. 3 AUGMENTOR INTERFERENCE

## SPECIAL CASE TEST

## DATA SHEET

(1) Date 2-6-77 (2) Time 1355

(2) Test Name: Augmentor Interference

(3) Augmentor A ID 52 (4) Augmentor B ID 61

(5) Distance

| | A-B | A Detection | | B Detection | |
|---|---|---|---|---|---|
| TEST # | (Feet) | Correct | Incorrect | Correct | Incorrect |
| 30301 | 200 | ✓ | | ✓ | [illegible] |
| 30302 | 200 | ✓ | | ✓ | |
| 30303 | 150 | ✓ | | ✓ | |
| 30304 | 150 | ✓ | | ✓ | |
| 30305 | 100 | | ✓ | ✓ | |
| 30306 | 100 | ✓ (LATE) | | ✓ | |
| 30307 | 50 | | ✓ | | ✓ |
| 30310 | 50 | | ✓ | ✓ | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

(6) Remarks APPROACHED AUGMENTORS FROM "B" TO "A" DUE TO IMBALANCE IN AUGMENTORS; "A" WAS STRONGER & WAS OVERLAPPING WHEN APPROACHED FROM "A" DIRECTION – THIS PREVENTED AQUISITION OF "B" (UNLESS APPROACHED FROM "B" DIRECTION).

(7) Test Conductor

(8) Witnesses

## B. 4 AUGMENTOR RADIO INTERFERENCE

SPECIAL CASE TEST TEST #31001

DATA SHEET

(1) Date FEB. 9, 1977 (2) Time 1600

(2) Test Name: Radio Frequency Interference

(3) Augmentor ID 35

(4) Separation Distance ALL Ft.

(5) Augmentor ON [✓ OFF] Ambient noise -70 db

(6) Frequency / Amplitude

| Frequency | Amplitude |
|---|---|
| 67.5 | -32db |
| 82.1 | -45db |
| 66.6 | -55 |
| | |
| | |
| | |
| | |

(7) Remarks

(8) Test Conductor Barry E. B

(9) Witnesses Joseph P. [illegible] TSC

TEST # 31002

## SPECIAL CASE TEST
## DATA SHEET

(1) Date FEB 9, 1977 (2) Time 1600

(2) Test Name: Radio Frequency Interference

(3) Augmentor ID 35

(4) Separation Distance 10 Ft.

(5) Augmentor [✓ ON] OFF

(6)

| Frequency | Amplitude |
|---|---|
| 72.4 | -36 db |
| 76.3 | -65 db |
| | |
| | |
| | |
| | |
| | |

(7) Remarks 3 db bandwidth = 350 HZ
NO NOTICEABLE, MEASURABLE SIDE BANDS

(8) Test Conductor Barry E. B

(9) Witnesses Joseph JSC

TEST # 31003

## SPECIAL CASE TEST

## DATA SHEET

(1) Date FEB. 9, 1977 (2) Time 1600

(2) Test Name: Radio Frequency Interference

(3) Augmentor ID 35

(4) Separation Distance 20 Ft.

(5) Augmentor [✓ ON] OFF

(6)

| Frequency | Amplitude |
|---|---|
| 72.4 | -40 db |
| | |
| | |
| | |
| | |
| | |
| | |

(7) Remarks

(8) Test Conductor

(9) Witnesses TSC

Test # 31004

## SPECIAL CASE TEST
## DATA SHEET

(1) Date FEB. 9, 1977 (2) Time 1600

(2) Test Name: Radio Frequency Interference

(3) Augmentor ID 35

(4) Separation Distance 30 Ft.

(5) Augmentor [✓ ON] OFF

(6)

| Frequency | Amplitude |
|---|---|
| 72.4 | -54 db |
| | |
| | |
| | |
| | |
| | |
| | |

(7) Remarks

(8) Test Conductor Barry E. B

(9) Witnesses Joseph P. Kelly KSC

Test # 31005

SPECIAL CASE TEST
DATA SHEET

(1) Date FEB. 9, 1977 (2) Time 1600

(2) Test Name: Radio Frequency Interference

(3) Augmentor ID 35

(4) Separation Distance 40 Ft.

(5) Augmentor [✓ ON] OFF

(6)

| Frequency | Amplitude |
|---|---|
| 72.4 | -50 db |
| | |
| | |
| | |
| | |
| | |
| | |

(7) Remarks

(8) Test Conductor

(9) Witnesses TSC

Test # 31006

## SPECIAL CASE TEST
## DATA SHEET

(1) Date FEB. 9, 1977 (2) Time 1600

(2) Test Name: Radio Frequency Interference

(3) Augmentor ID 35

(4) Separation Distance 50 Ft.

(5) Augmentor [✓ ON] OFF

(6)

| Frequency | Amplitude |
|---|---|
| 72.4 | -57 db |
| | |
| | |
| | |
| | |
| | |
| | |

(7) Remarks

(8) Test Conductor Barry E. B

(9) Witnesses TSC

Test # 31007

SPECIAL CASE TEST

DATA SHEET

(1) Date FEB. 9, 1977 (2) Time 1600

(2) Test Name: Radio Frequency Interference

(3) Augmentor ID 35

(4) Separation Distance 60 Ft.

(5) Augmentor [✓ ON] OFF

(6)

| Frequency | Amplitude |
|---|---|
| 72.4 | -58 db |
| | |
| | |
| | |
| | |
| | |
| | |

(7) Remarks

(8) Test Conductor Barry E. Br

(9) Witnesses

Test # 31010

SPECIAL CASE TEST

DATA SHEET

(1) Date Feb. 9, 1977 (2) Time 1600

(2) Test Name: Radio Frequency Interference

(3) Augmentor ID 35

(4) Separation Distance 70 Ft.

(5) Augmentor [✓ ON] OFF

(6)

| Frequency | Amplitude |
|---|---|
| 72.4 | -58 db |

(7) Remarks

(8) Test Conductor Barry E. B

(9) Witnesses TSC

Test # 31011

SPECIAL CASE TEST

DATA SHEET

(1) Date FEB. 9, 1977 (2) Time 1600

(2) Test Name: Radio Frequency Interference

(3) Augmentor ID 35

(4) Separation Distance 80 Ft.

(5) Augmentor [✓ ON] OFF

(6)

| Frequency | Amplitude |
|---|---|
| 72.4 | -62 db |
| | |
| | |
| | |
| | |
| | |
| | |

(7) Remarks

(8) Test Conductor Barry E. B

(9) Witnesses

Test # 31012

SPECIAL CASE TEST

DATA SHEET

(1) Date FEB. 9, 1977 (2) Time 1600

(2) Test Name: Radio Frequency Interference

(3) Augmentor ID 35

(4) Separation Distance 90 Ft.

(5) Augmentor [✓ ON] OFF

(6)

| Frequency | Amplitude |
|---|---|
| 72.4 | -60 db |
| | |
| | |
| | |
| | |
| | |
| | |

(7) Remarks

(8) Test Conductor Bay E. B

(9) Witnesses TSC

Test # 31013

SPECIAL CASE TEST

DATA SHEET

(1) Date FEB. 9, 1977 (2) Time 1600

(2) Test Name: Radio Frequency Interference

(3) Augmentor ID 35

(4) Separation Distance 100 Ft.

(5) Augmentor [✓ ON] OFF

(6) Frequency Amplitude

LOSS ON SPECTRUM ANALYZER

-70 db

(7) Remarks

(8) Test Conductor

(9) Witnesses TSC

## B. 5 AUGMENTOR ANTENNA PATTERN

Test # 32001

### SPECIAL CASE TEST

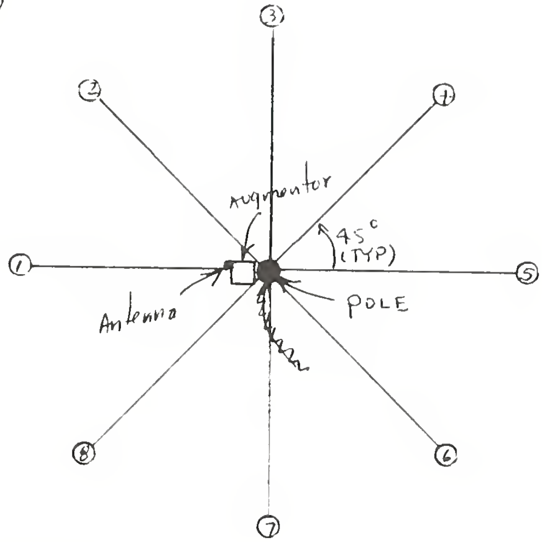
### DATA SHEET

(1) Date MARCH 5, 1977 (2) Time 1 PM

(3) Test Name: Augmentor Antenna Pattern

(4) Augmentor ID 67

(5) Plan View



(6) 'Acquire' Light On

| Line | Distance | Line | Distance |
|---|---|---|---|
| 1 | 130 | 5 | 81 |
| 2 | 123 | 6 | 81 |
| 3 | 111 | 7 | 71 |
| 4 | 107 | 8 | 63 |

(7) Remarks 1) AUGMENTOR ELEVATION 10 FT.

2) Augmentor Antenna towards "①"

(8) Test Conductor Barry E. Br 3/5/77 (9) Assistant Staplet

(10) Witnesses

Test #. 32002

## SPECIAL CASE TEST

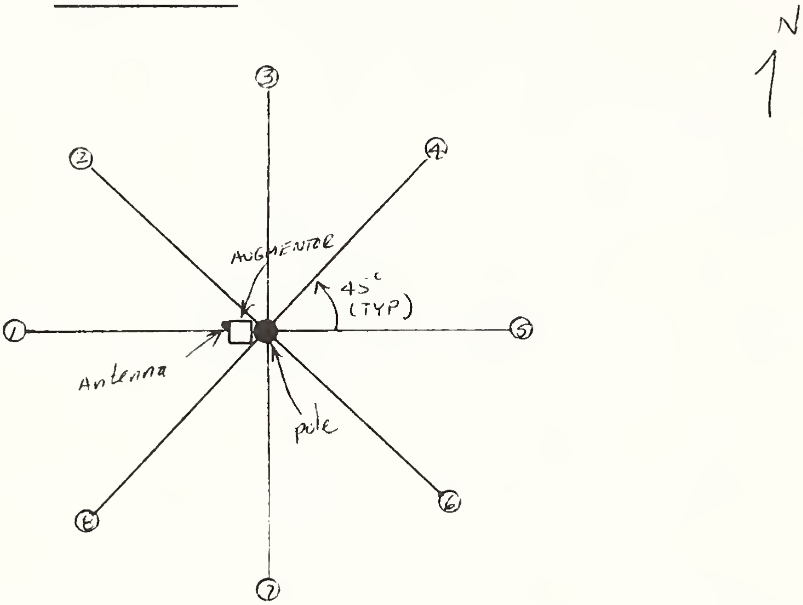
## DATA SHEET

(1) Date MARCH 5, 1977 (2) Time 1:20 PM

(3) Test Name: Augmentor Antenna Pattern

(4) Augmentor ID 67

(5) Plan View



(6) 'Acquire' Light On

| Line | Distance | Line | Distance |
|---|---|---|---|
| 1 | 135 | 5 | 120 |
| 2 | 132 | 6 | 122 |
| 3 | 114 | 7 | 119 |
| 4 | 130 | 8 | 129 |

(7) Remarks 1) AUGMENTOR ELEVATION 15 FT.
2) AUGMENTOR ANTENNA TOWARDS "①"

(8) Test Conductor Barry F Br 3/5/77 (9) Assistant Staplet

(10) Witnesses

Test # 32003

# SPECIAL CASE TEST

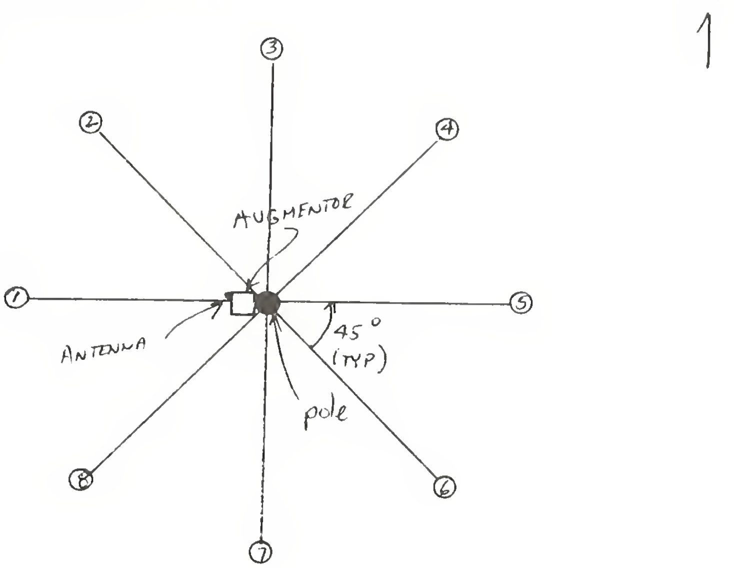
# DATA SHEET

(1) Date MARCH 5, 1977 (2) Time 1:45 PM

(3) Test Name: Augmentor Antenna Pattern

(4) Augmentor ID 67

(5) Plan View



(6) 'Acquire' Light On

| Line | Distance | Line | Distance |
|---|---|---|---|
| 1 | 168 | 5 | 127 |
| 2 | 152 | 6 | 129 |
| 3 | 140 | 7 | 155 |
| 4 | 125 | 8 | 180 |

(7) Remarks 1) AUGMENTOR ELEVATION 20 FT

2) AUGMENTOR ANTENNA TOWARDS "①"

(8) Test Conductor 3/5/77 (9) Assistant

(10) Witnesses

# APPENDIX C
## AUGMENTOR LOCATION SUMMARY

This appendix lists all augmentor ID's used in the Philadelphia Phase I tests. A listing according to street location for the fixed and random routes follows this page. In addition, a numerical listing by ID code follows, showing the detailed location coordinates for each augmentor. At the end of the Appendix, Figures C-1 and C-2 show the map locations of each for the fixed and random routes, respectively.

### Fixed Route

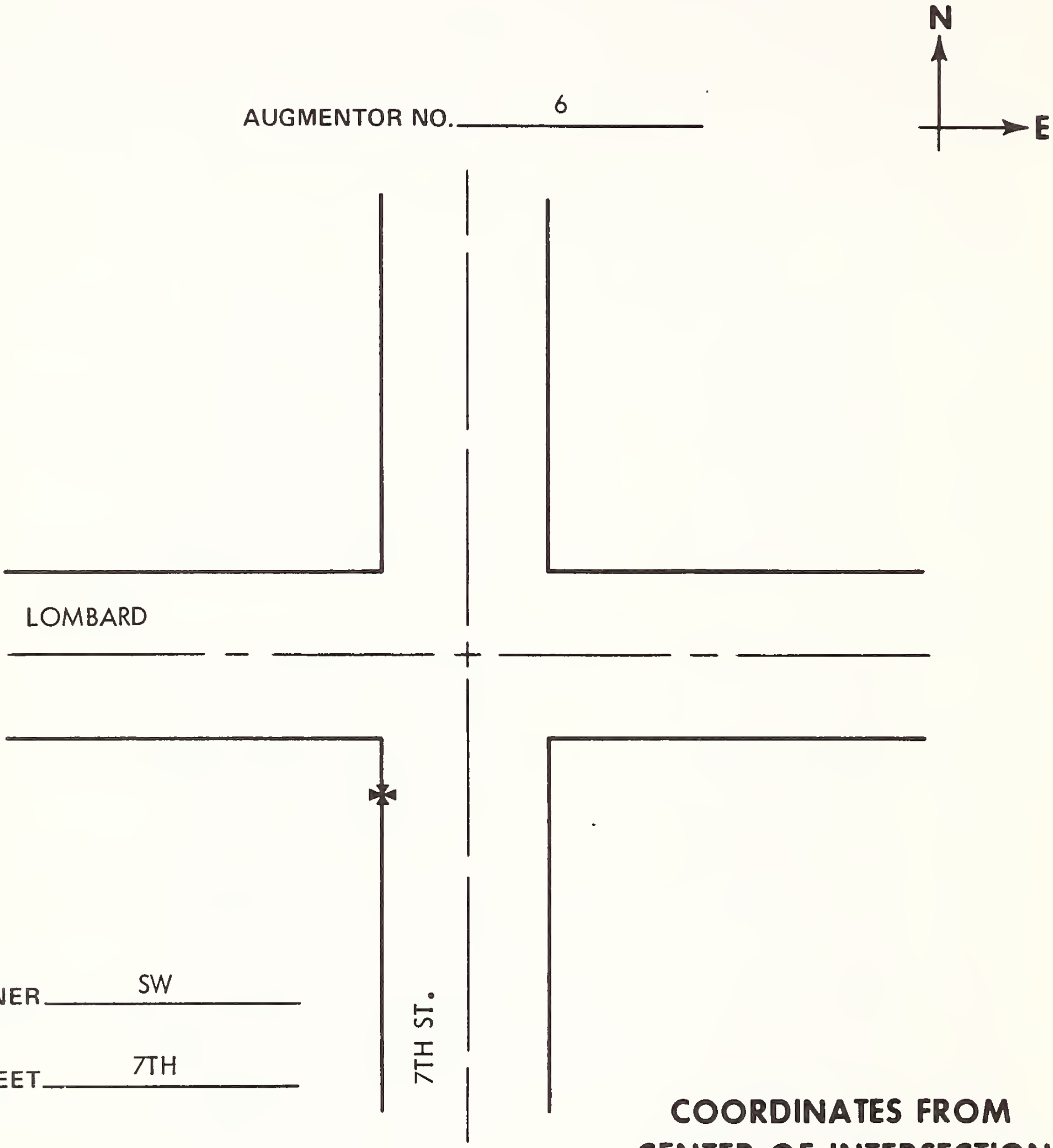
| Aug ID | Location | Aug ID | Location |
|---|---|---|---|
| 35 | Spring Garden & Broad | 100 | 22nd & Chestnut |
| 24 | Broad & Arch | 15 | 18th & Vine |
| 30 | JFK & Expressway | 51 | BF Parkway & 22nd |
| 57 | 20th & Market | 53 | 19th & Pine |
| 31 | 11th & Market | 67 | 10th & Pine |
| 33 | 10th & Walnut | 54 | 8th & Spruce |
| 37 | 18th & Walnut | 32 | 13th & Chestnut |
| 72 | 33rd & Walnut | 110 | 13th & Spring Garden |

### Random Route

| | | | |
|---|---|---|---|
| 50 | Broad & Walnut | 07 | 11th & Locust |
| 16 | Broad & Locust | 111 | 11th & Spruce |
| 44 | Broad & Spruce | 112 | 11th & Pine |
| 70 | Broad & Pine | 137 | 11th & Lombard |
| 42 | Broad & Lombard | 77 | 10th & Locust |
| 45 | 13th & Walnut | 113 | 10th & Spruce |
| 43 | 13th & Locust | 67 | 10th & Pine |
| 17 | 13th & Spruce | 10 | 9th & Walnut |
| 22 | 13th & Lombard | 11 | 9th & Locust |
| 26 | 12th & Walnut | 12 | 9th & Spruce |
| 27 | 12th & Locust | 21 | 9th & Lombard |
| 40 | 12th & Spruce | 76 | 8th & Walnut |
| 14 | 11th & Walnut | 74 | 8th & Pine |
| 75 | 8th & Lombard | 107 | 8th & South |
| 63 | W. Wash. Sq. & Locust | 20 | S. Wash. Sq. & 7th |
| 6 | 7th & Lombard | 73 | 6th & Walnut |
| 66 | 6th & Lomnard | 55 | 5th & Walnut |
| 46 | 5th & South | 13 | 4th & Spruce |
| 62 | 4th & Pine | 60 | 4th & Lombard |

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 6



CORNER SW

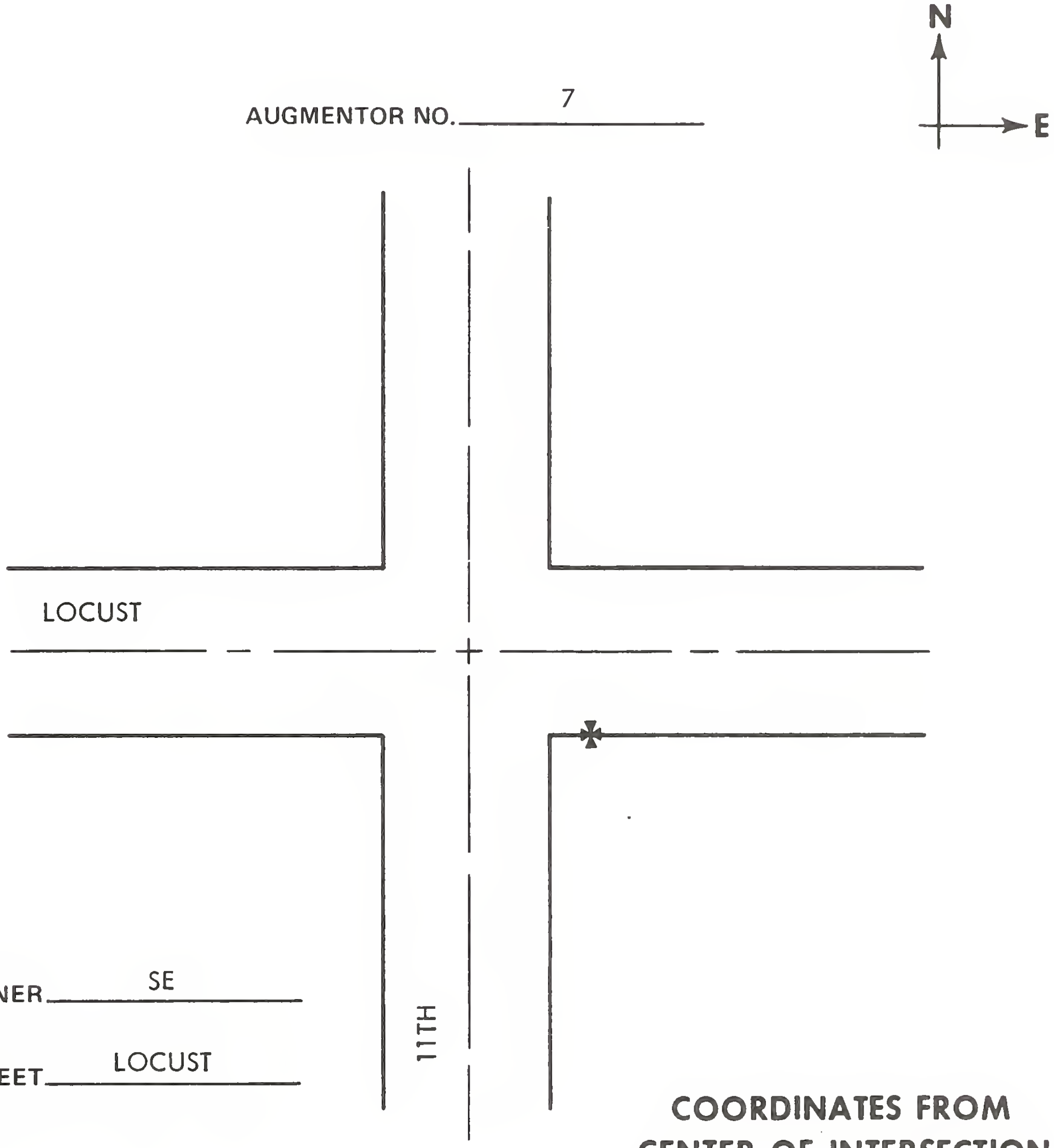
STREET 7TH

**COORDINATES FROM CENTER OF INTERSECTION**

27 FT SOUTH
14 FT WEST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 7



CORNER SE

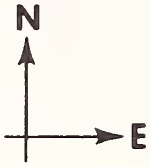
STREET LOCUST

**COORDINATES FROM CENTER OF INTERSECTION**

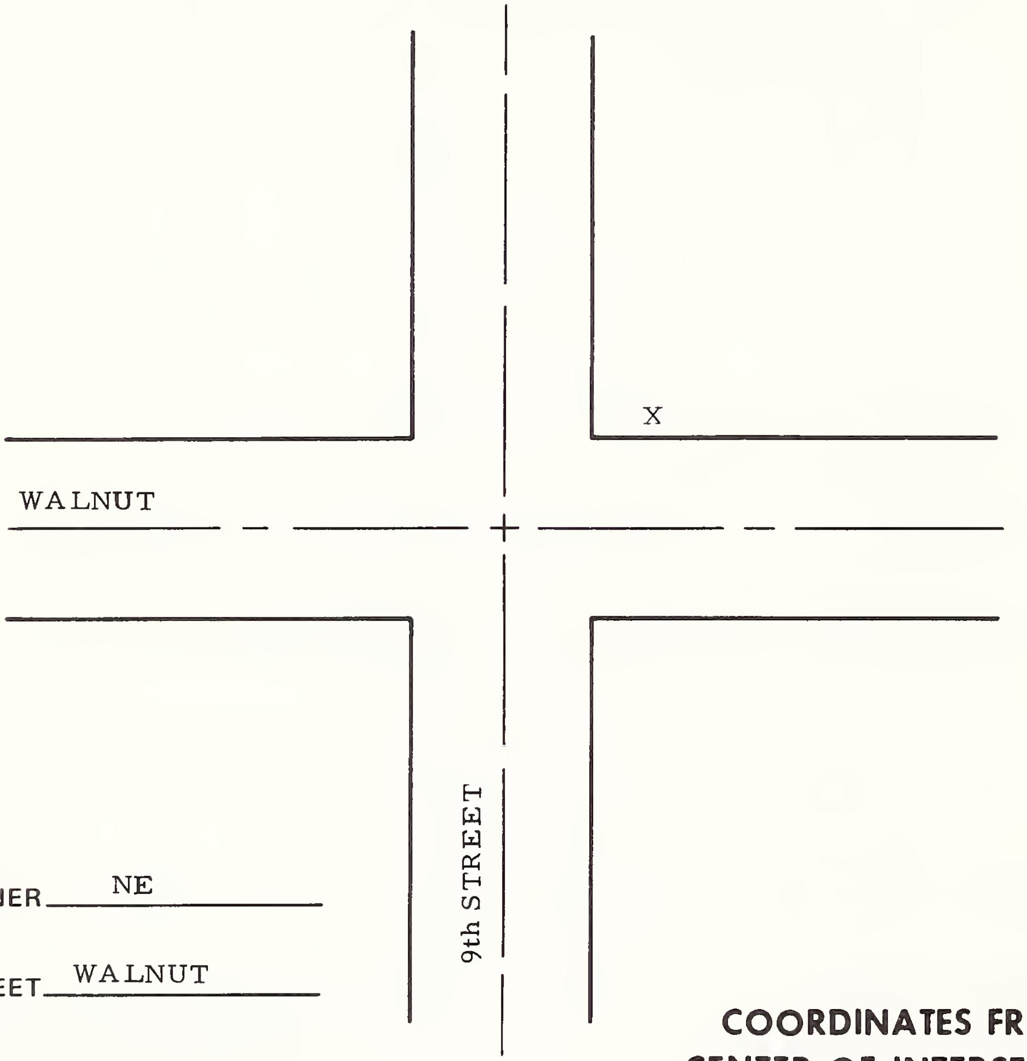
14 FT SOUTH
23 FT EAST

Revised 1/7/77

# AUGMENTOR LOCATION DESCRIPTION



AUGMENTOR NO. 10



CORNER NE

STREET WALNUT

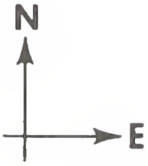
## COORDINATES FROM CENTER OF INTERSECTION

15 FT NORTH

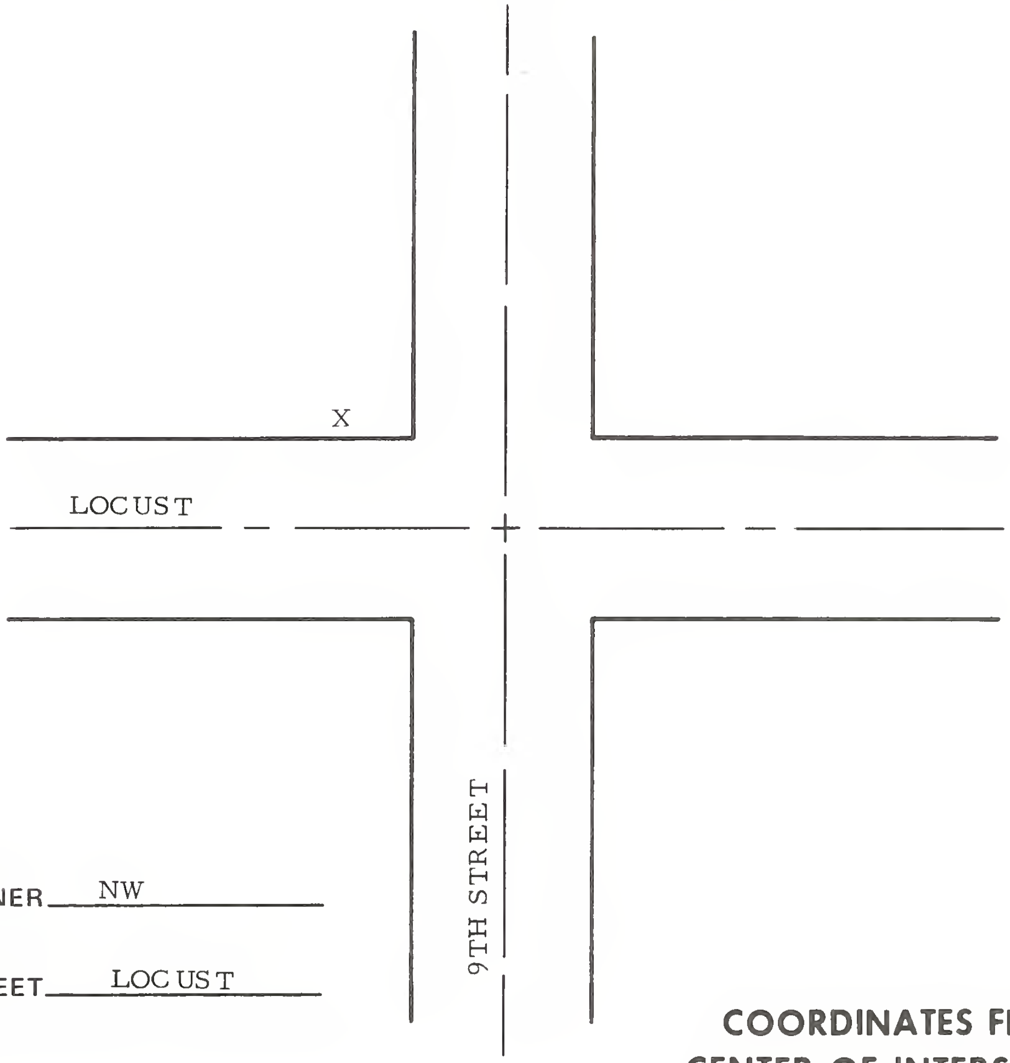
26 FT EAST

Revised 1/7/77

# AUGMENTOR LOCATION DESCRIPTION



AUGMENTOR NO. 11



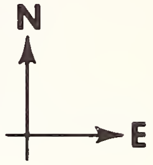
CORNER NW

STREET LOCUST

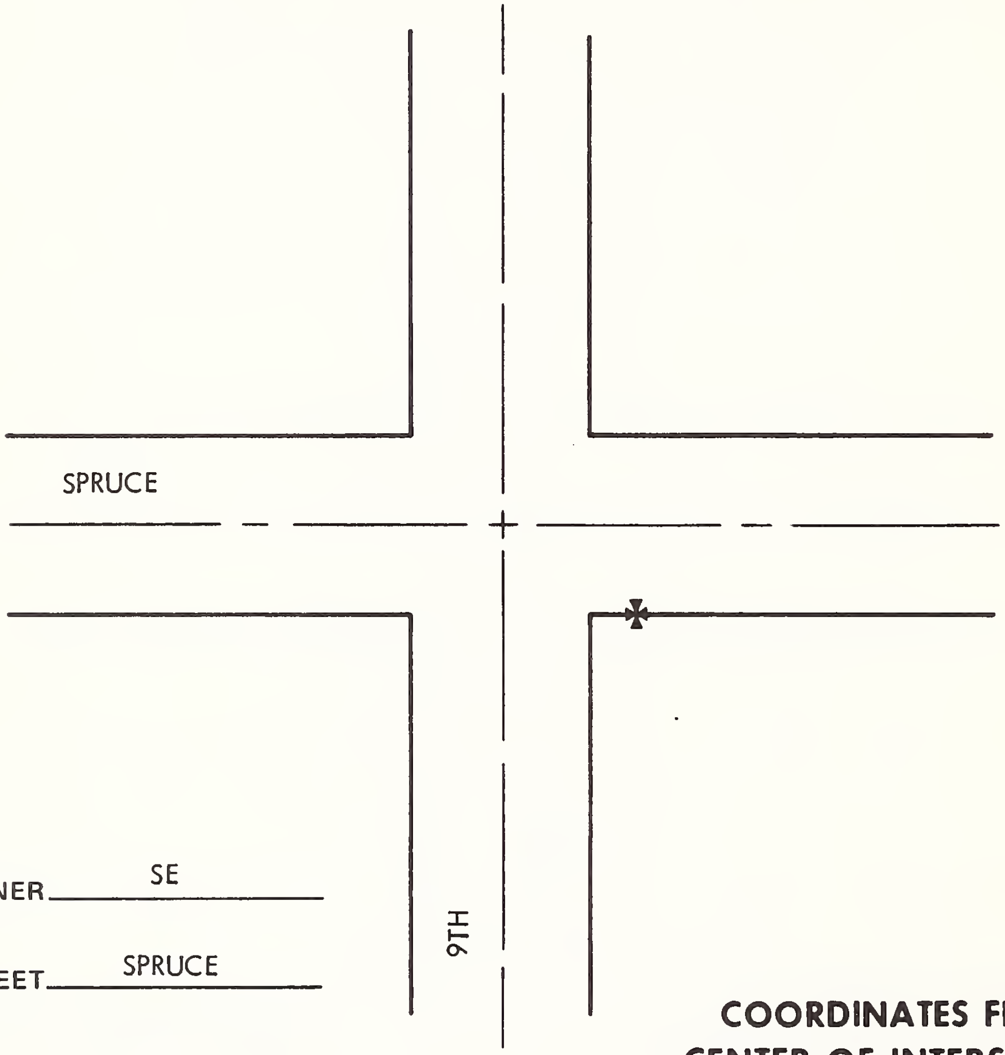
## COORDINATES FROM CENTER OF INTERSECTION

14 FT NORTH
22 FT WEST

# AUGMENTOR LOCATION DESCRIPTION



AUGMENTOR NO. 12



CORNER SE

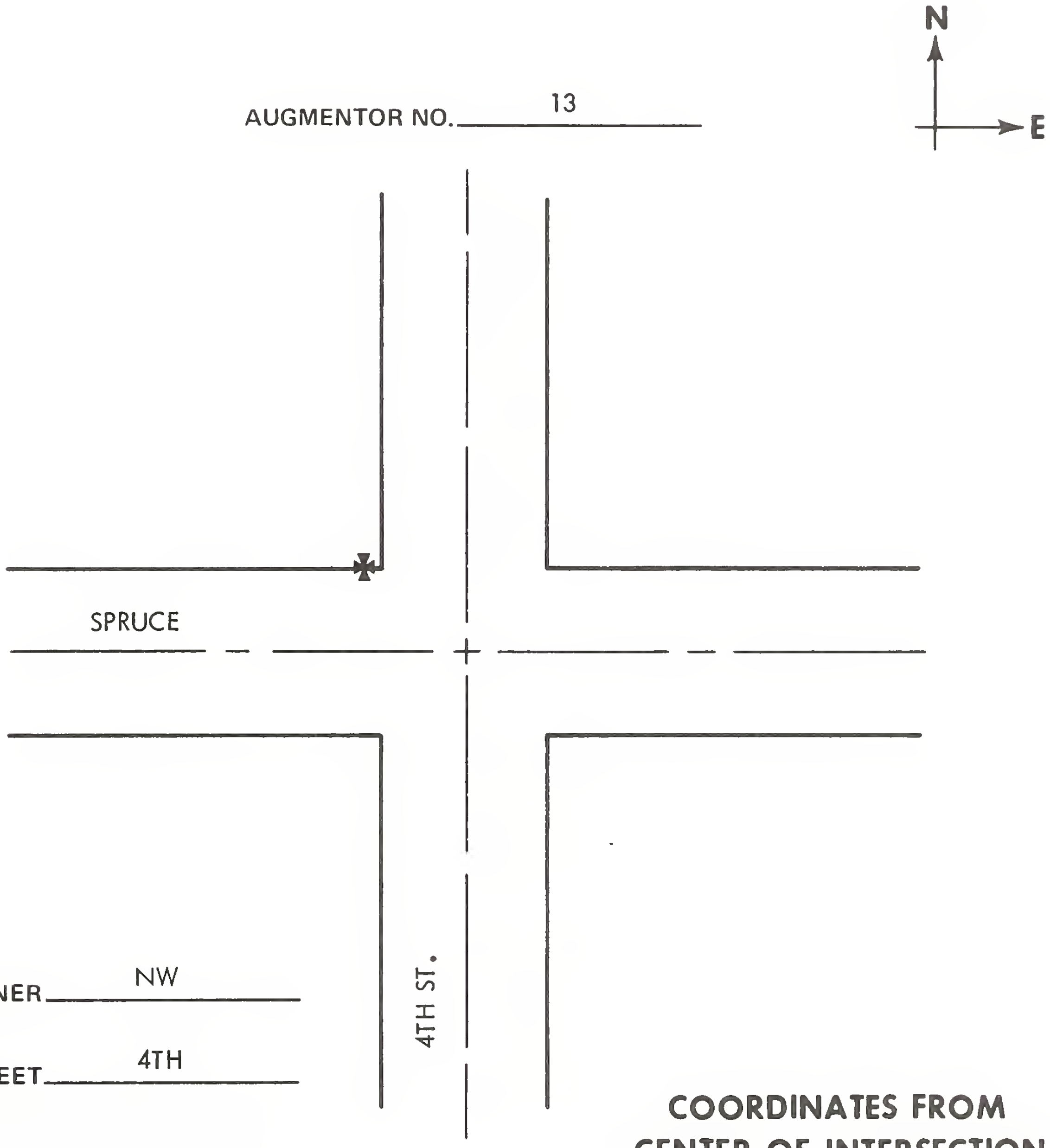
STREET SPRUCE

**COORDINATES FROM CENTER OF INTERSECTION**

16 FT SOUTH
25 FT EAST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 13



CORNER NW

STREET 4TH

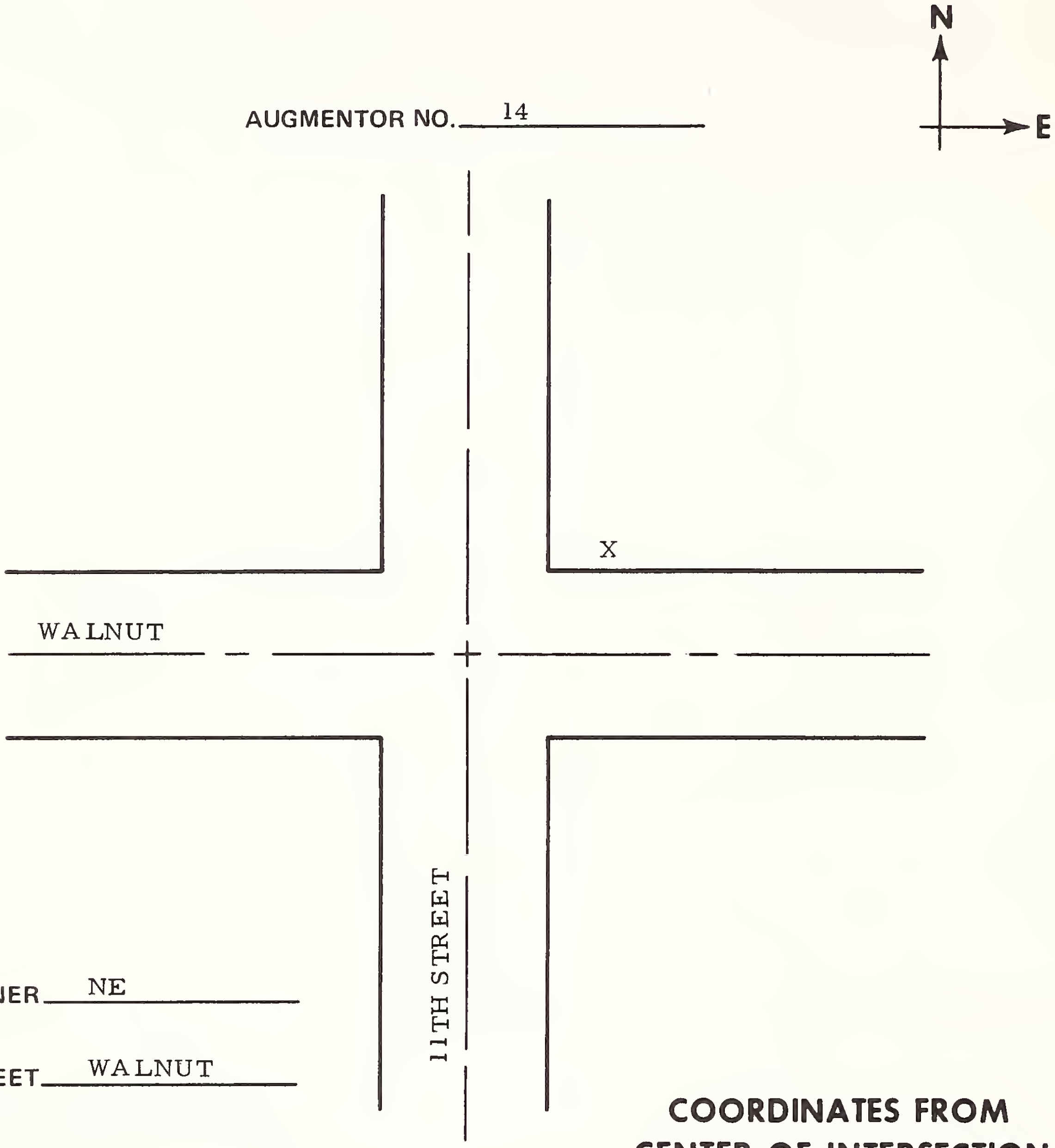
**COORDINATES FROM CENTER OF INTERSECTION**

24 FT NORTH
14 FT WEST

Revised 1/7/77

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 14



CORNER NE

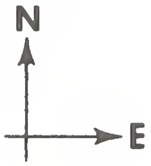
STREET WALNUT

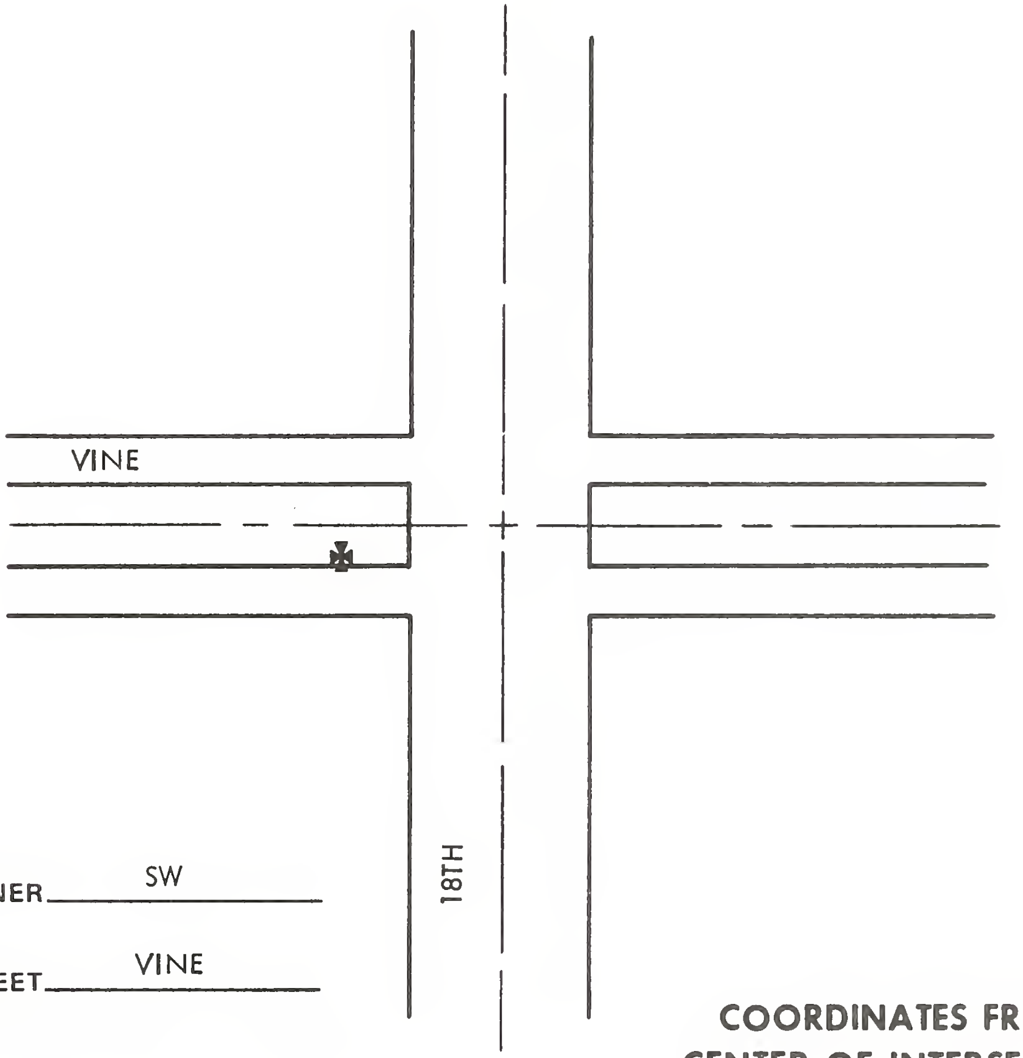
**COORDINATES FROM CENTER OF INTERSECTION**

15 FT NORTH
25 FT EAST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 15





CORNER SW

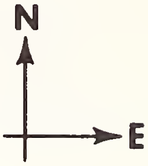
STREET VINE

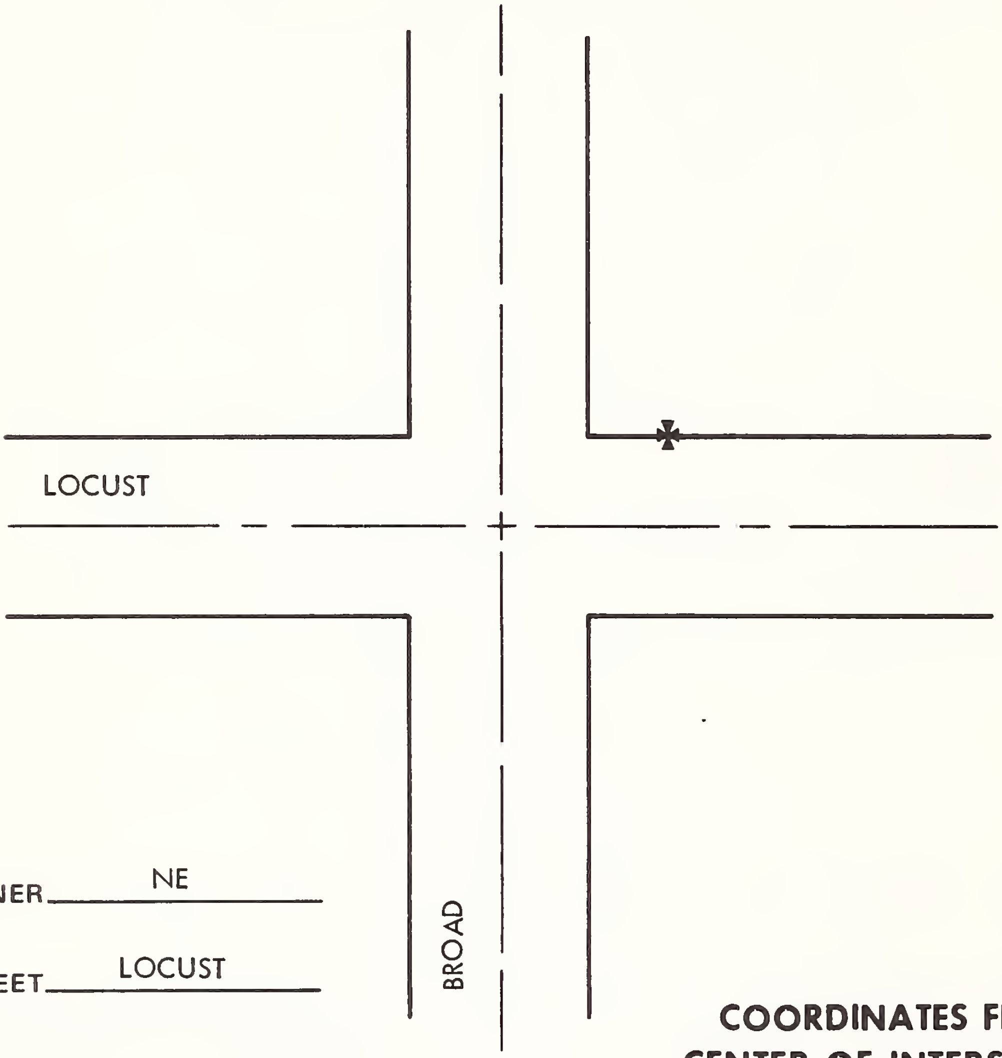
**COORDINATES FROM CENTER OF INTERSECTION**

64 FT SOUTH
23 FT WEST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 16





CORNER NE

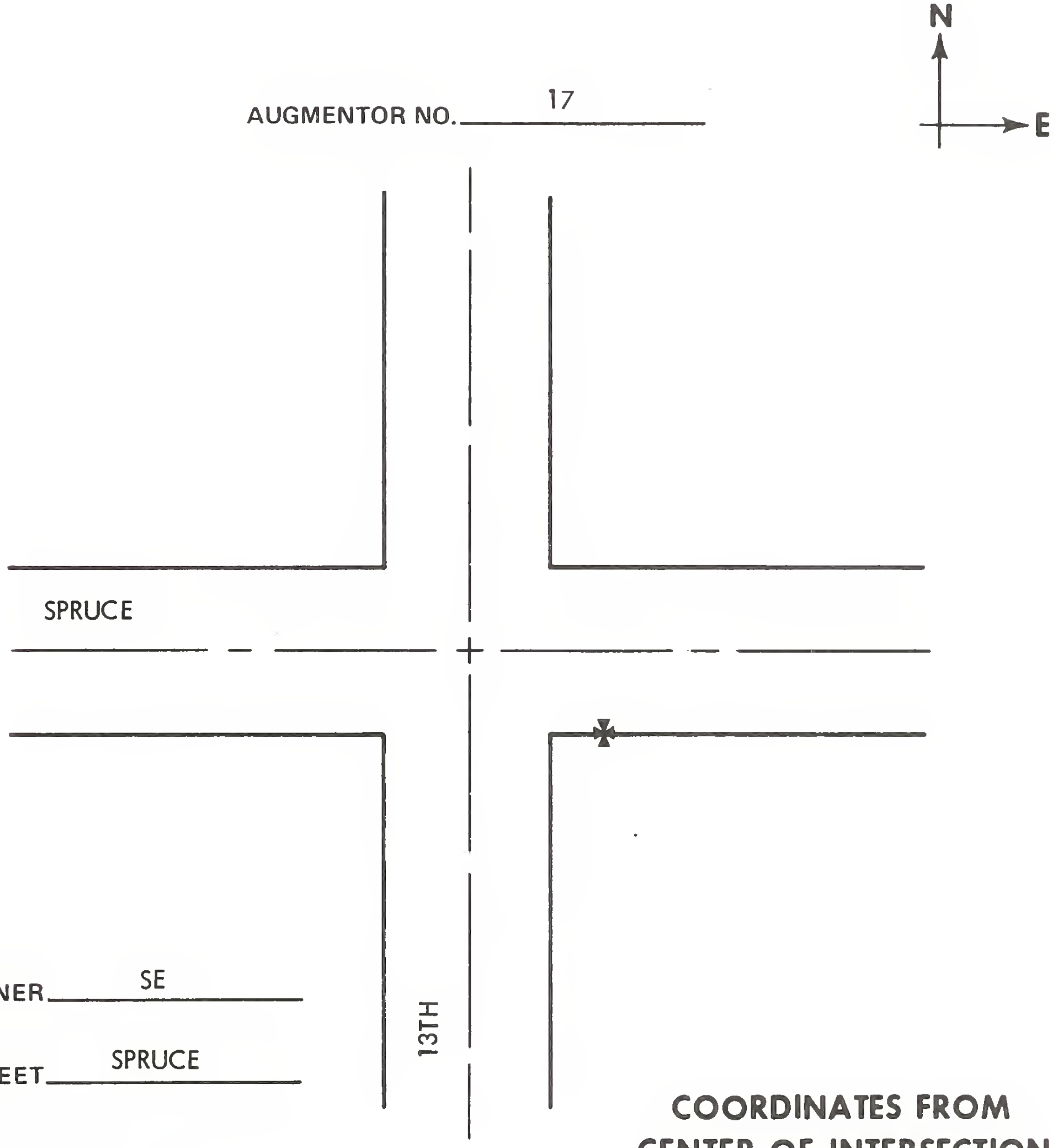
STREET LOCUST

**COORDINATES FROM CENTER OF INTERSECTION**

22 FT NORTH
54 FT EAST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 17



CORNER SE

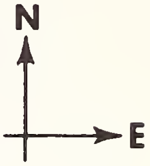
STREET SPRUCE

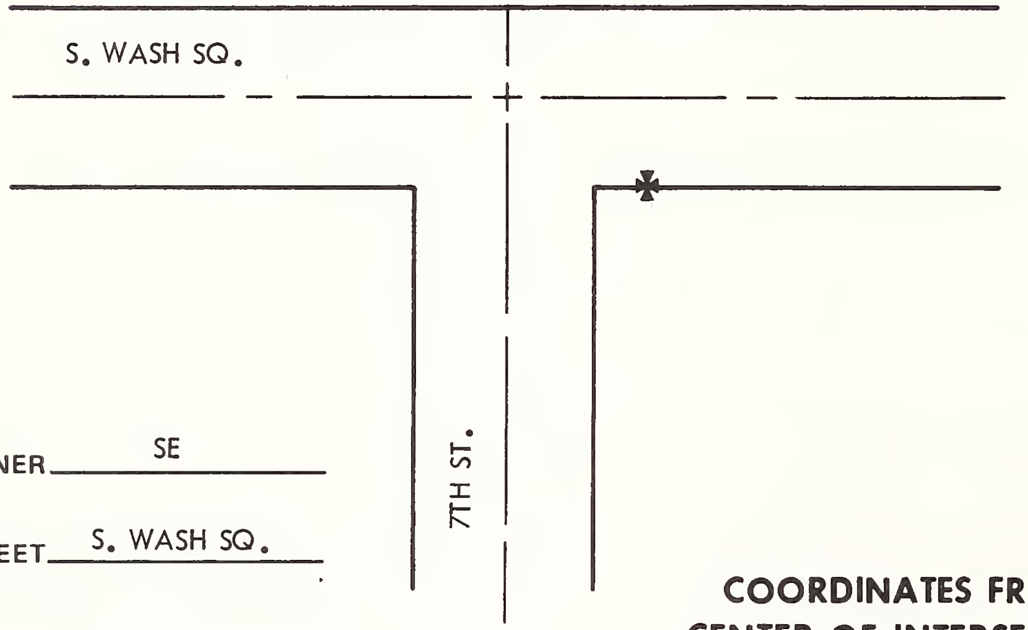
**COORDINATES FROM CENTER OF INTERSECTION**

15 FT SOUTH
26 FT EAST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 20





CORNER SE

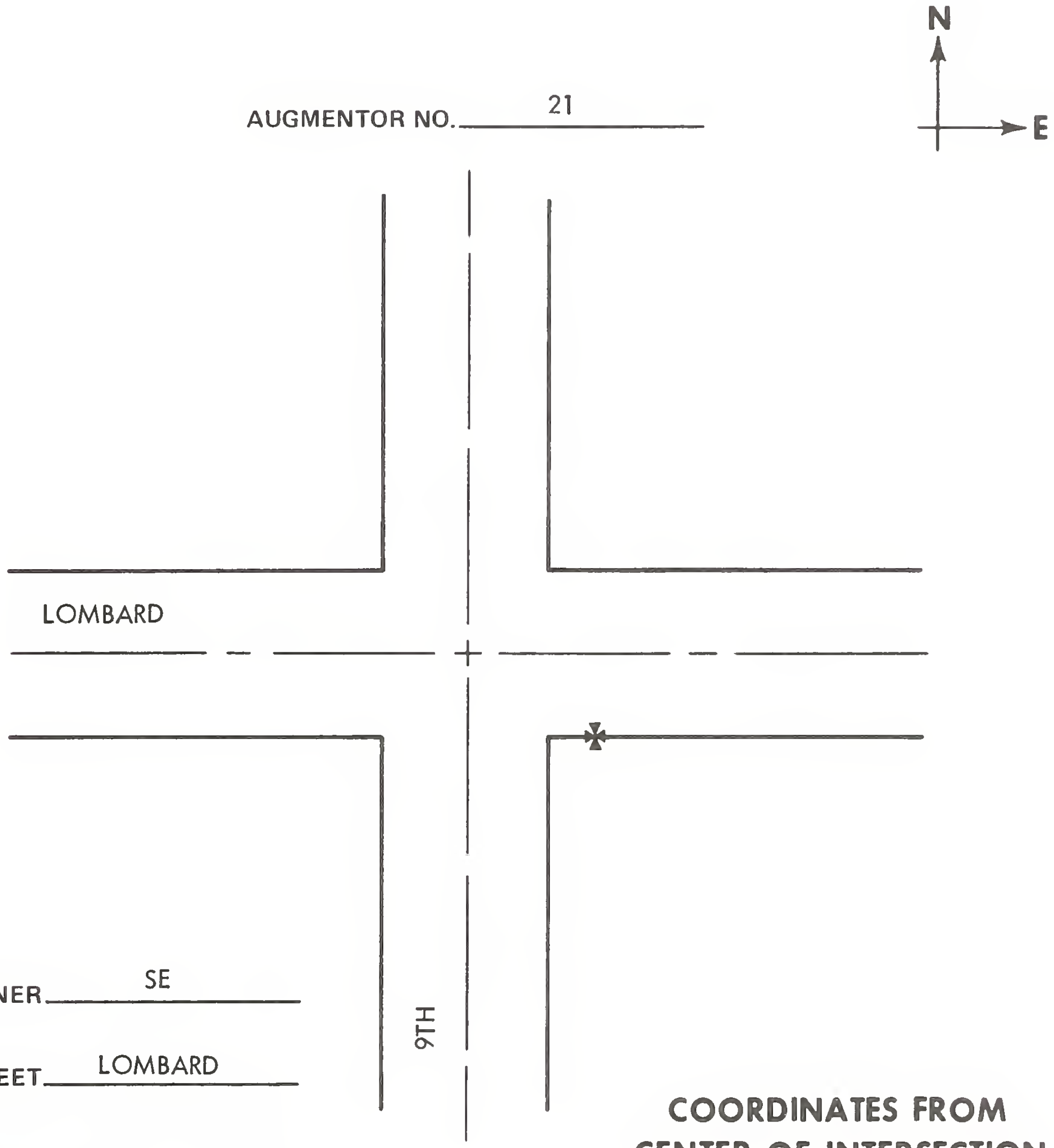
STREET S. WASH SQ.

**COORDINATES FROM CENTER OF INTERSECTION**

15 FT SOUTH
26 FT EAST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 21



CORNER SE

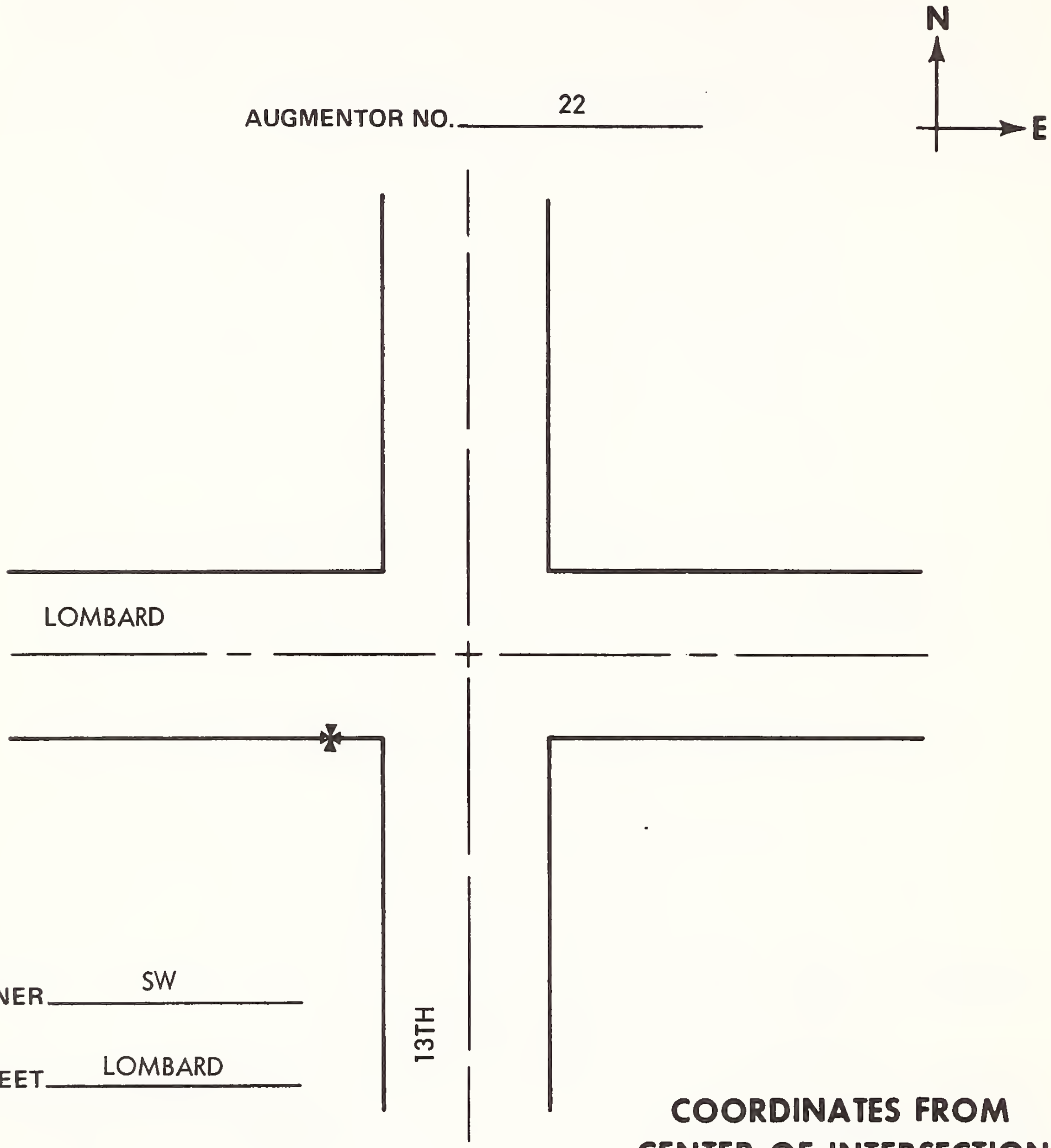
STREET LOMBARD

**COORDINATES FROM CENTER OF INTERSECTION**

16 FT SOUTH
26 FT EAST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 22



CORNER SW

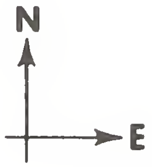
STREET LOMBARD

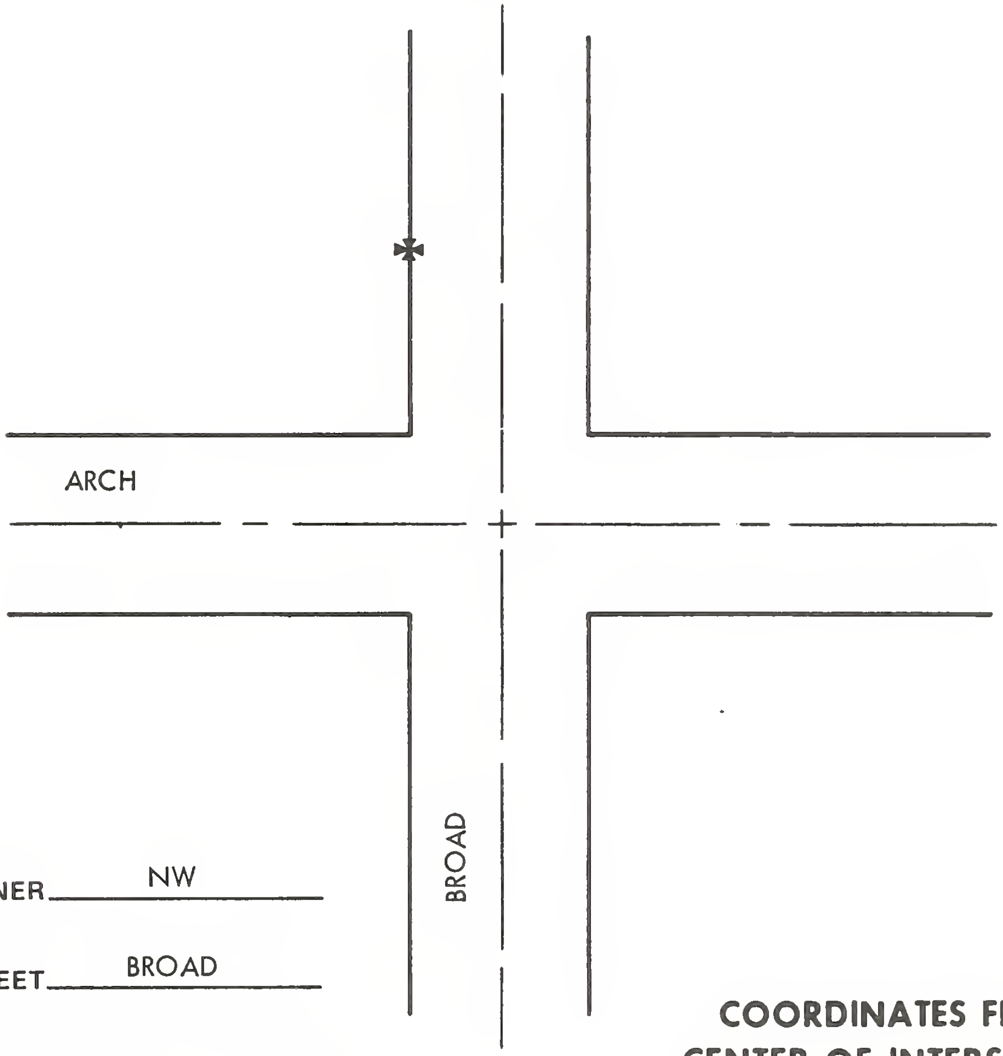
**COORDINATES FROM CENTER OF INTERSECTION**

16 FT SOUTH
23 FT WEST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 24





CORNER NW

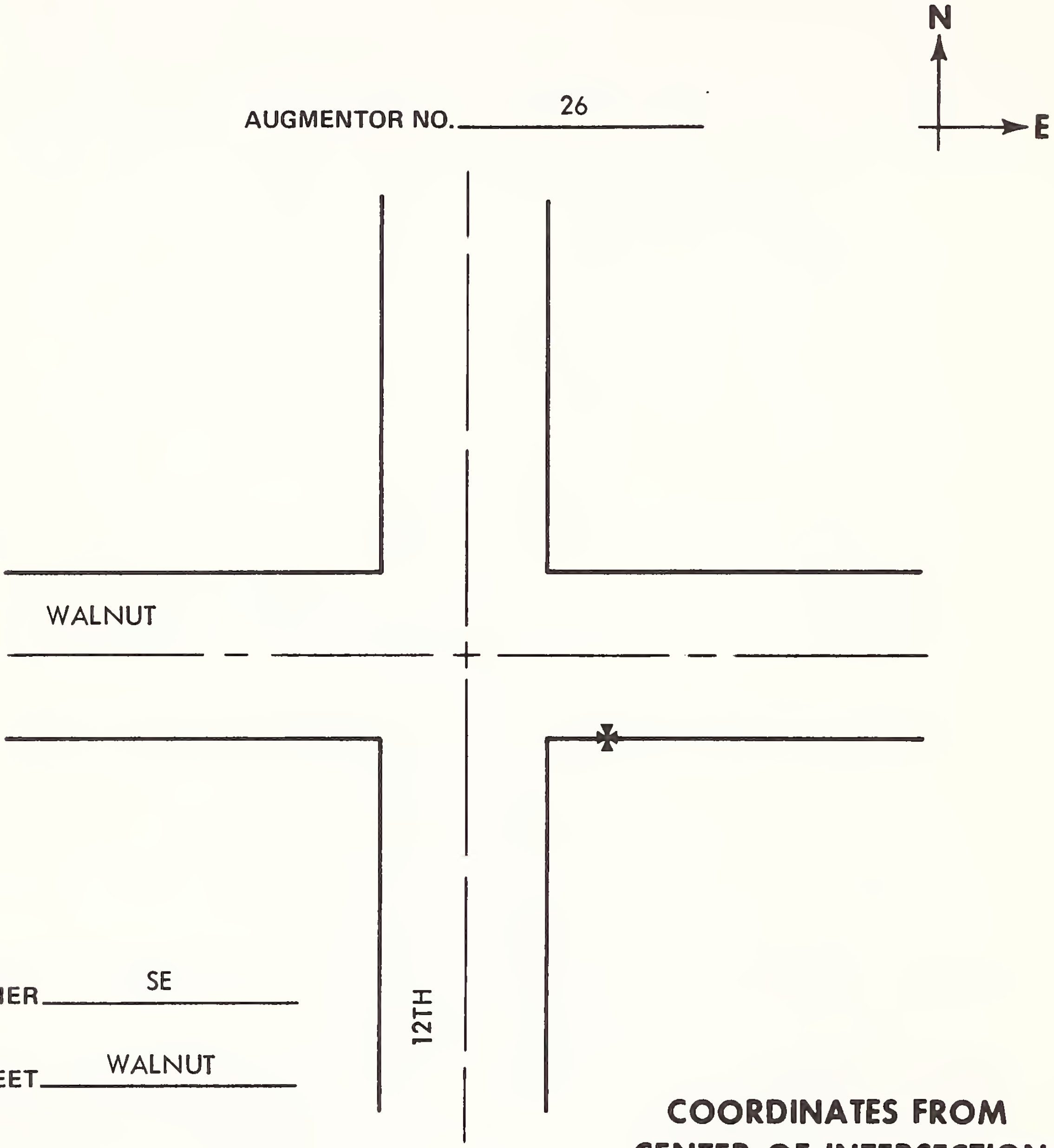
STREET BROAD

## COORDINATES FROM CENTER OF INTERSECTION

89 FT NORTH
36.5 FT WEST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 26



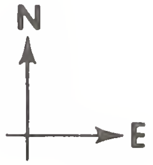
CORNER SE

STREET WALNUT

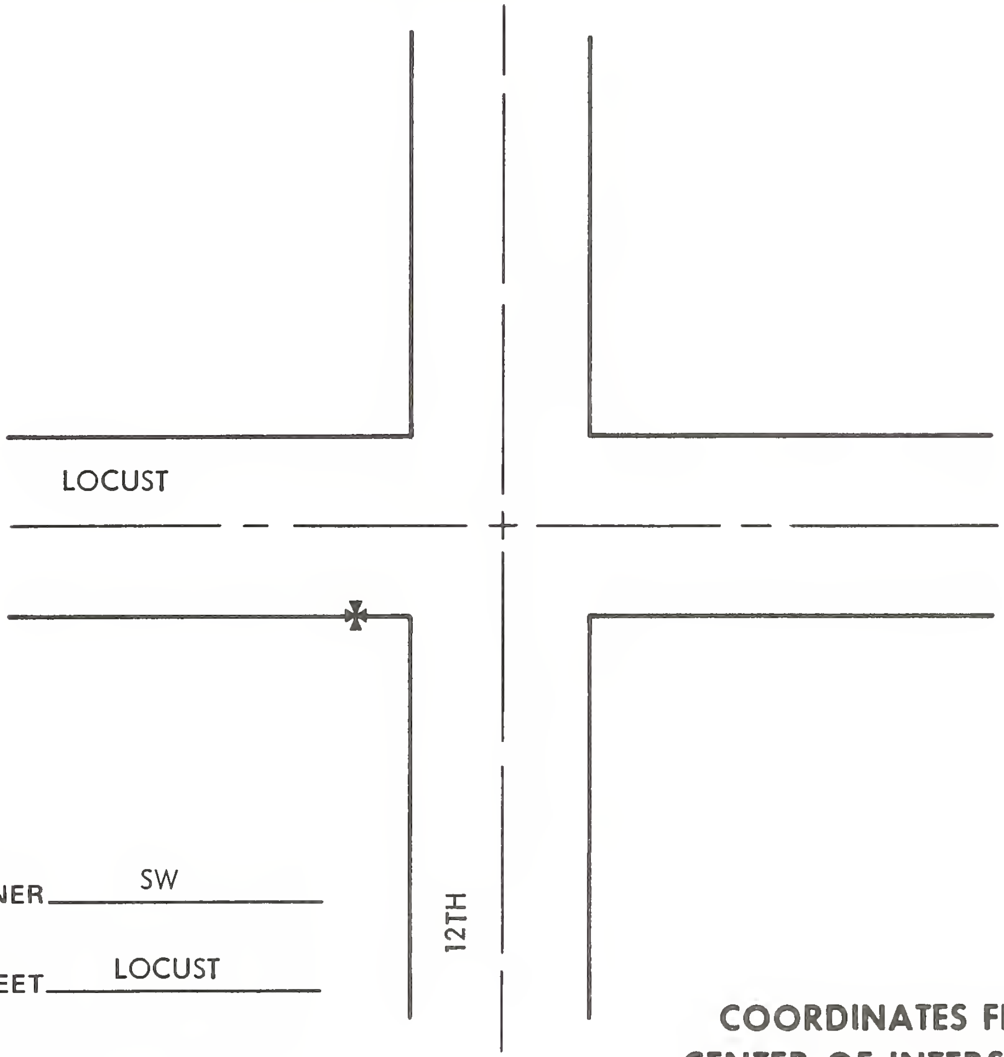
**COORDINATES FROM CENTER OF INTERSECTION**

15 FT SOUTH
25 FT EAST

# AUGMENTOR LOCATION DESCRIPTION



AUGMENTOR NO. 27



CORNER SW

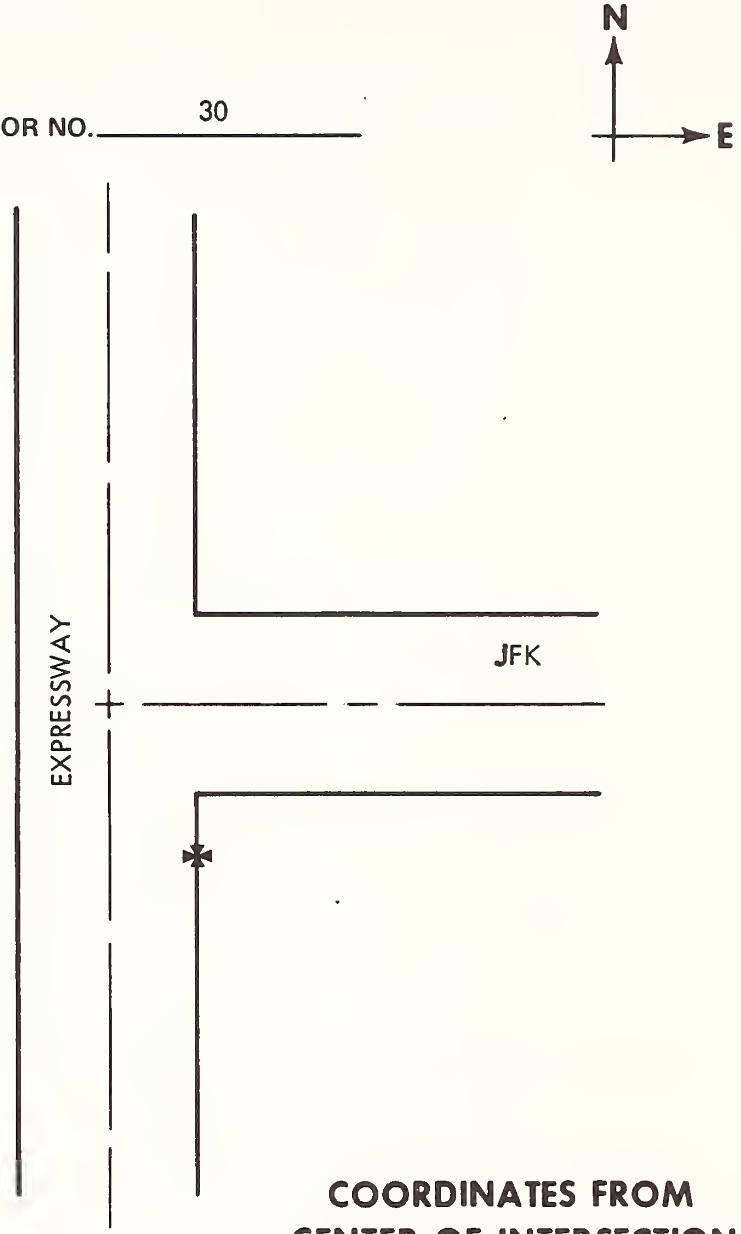
STREET LOCUST

**COORDINATES FROM CENTER OF INTERSECTION**

15 FT SOUTH
23 FT WEST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 30



CORNER SE

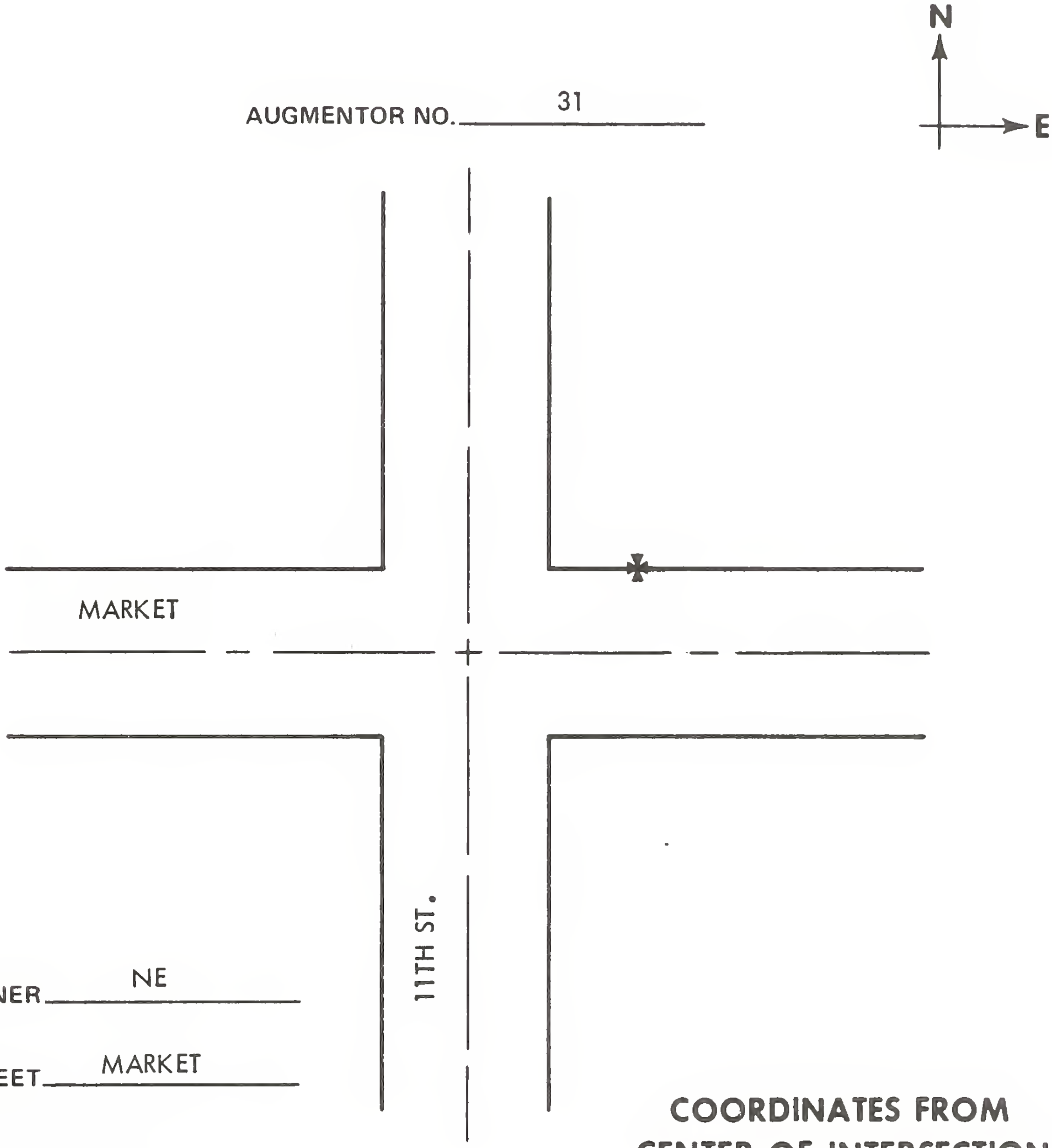
STREET JFK

**COORDINATES FROM CENTER OF INTERSECTION**

56 FT SOUTH
38 FT EAST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 31



CORNER NE

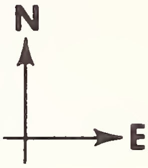
STREET MARKET

**COORDINATES FROM CENTER OF INTERSECTION**

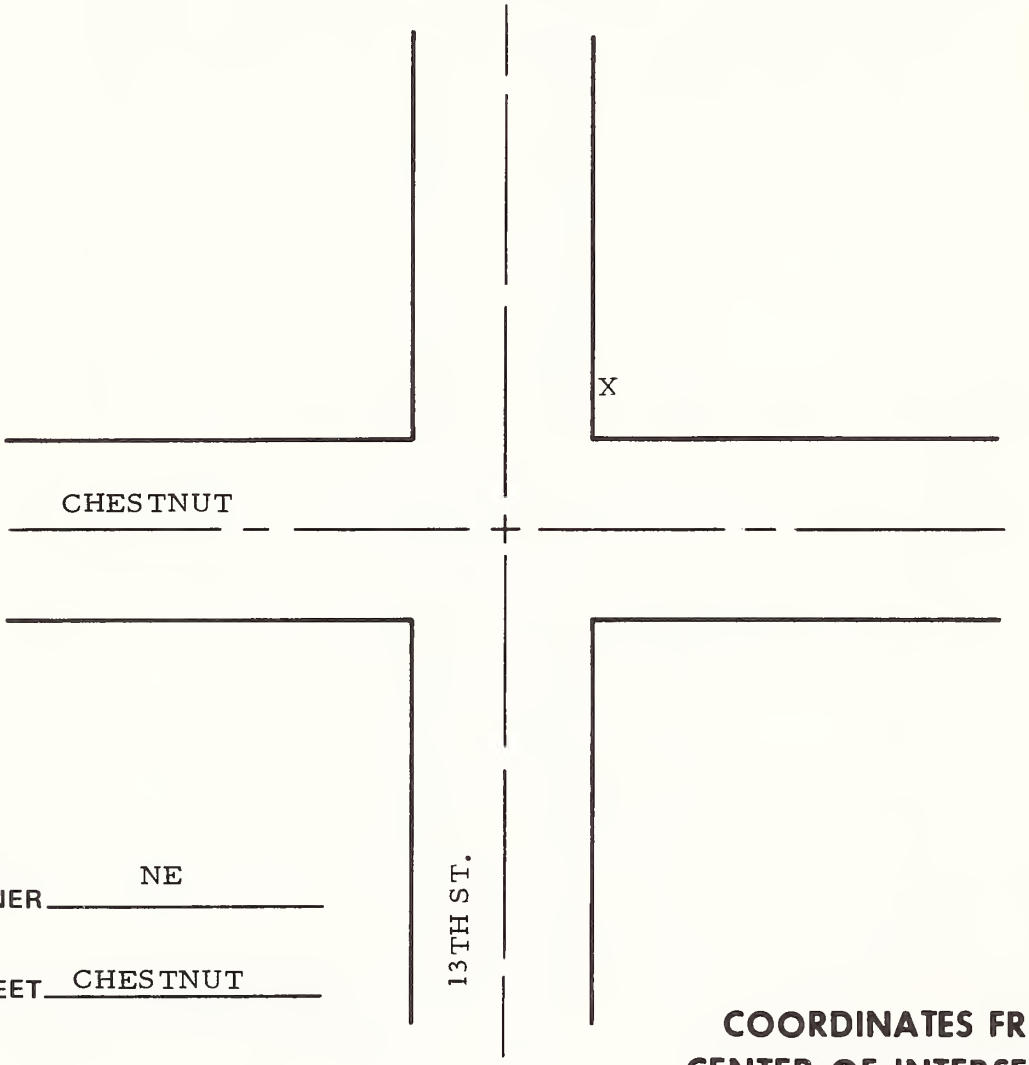
33.5 FT NORTH
28.5 FT EAST

Revised 2-16

# AUGMENTOR LOCATION DESCRIPTION



AUGMENTOR NO. 32



CORNER NE

STREET CHESTNUT

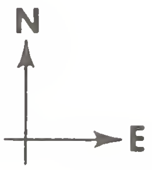
## COORDINATES FROM CENTER OF INTERSECTION

32 FT NORTH

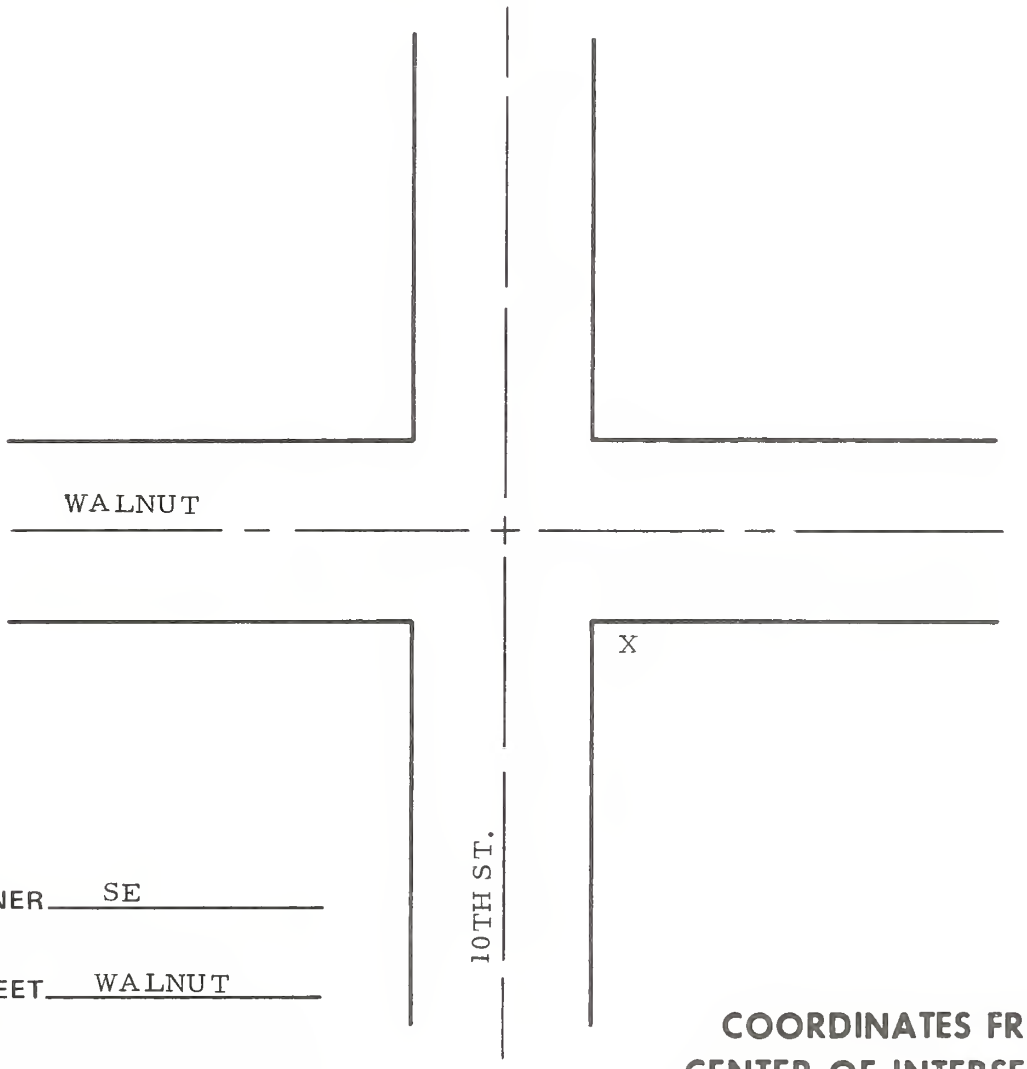
15 FT EAST

Revised 1/7/77

# AUGMENTOR LOCATION DESCRIPTION



AUGMENTOR NO. 33



CORNER SE

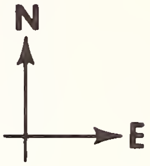
STREET WALNUT

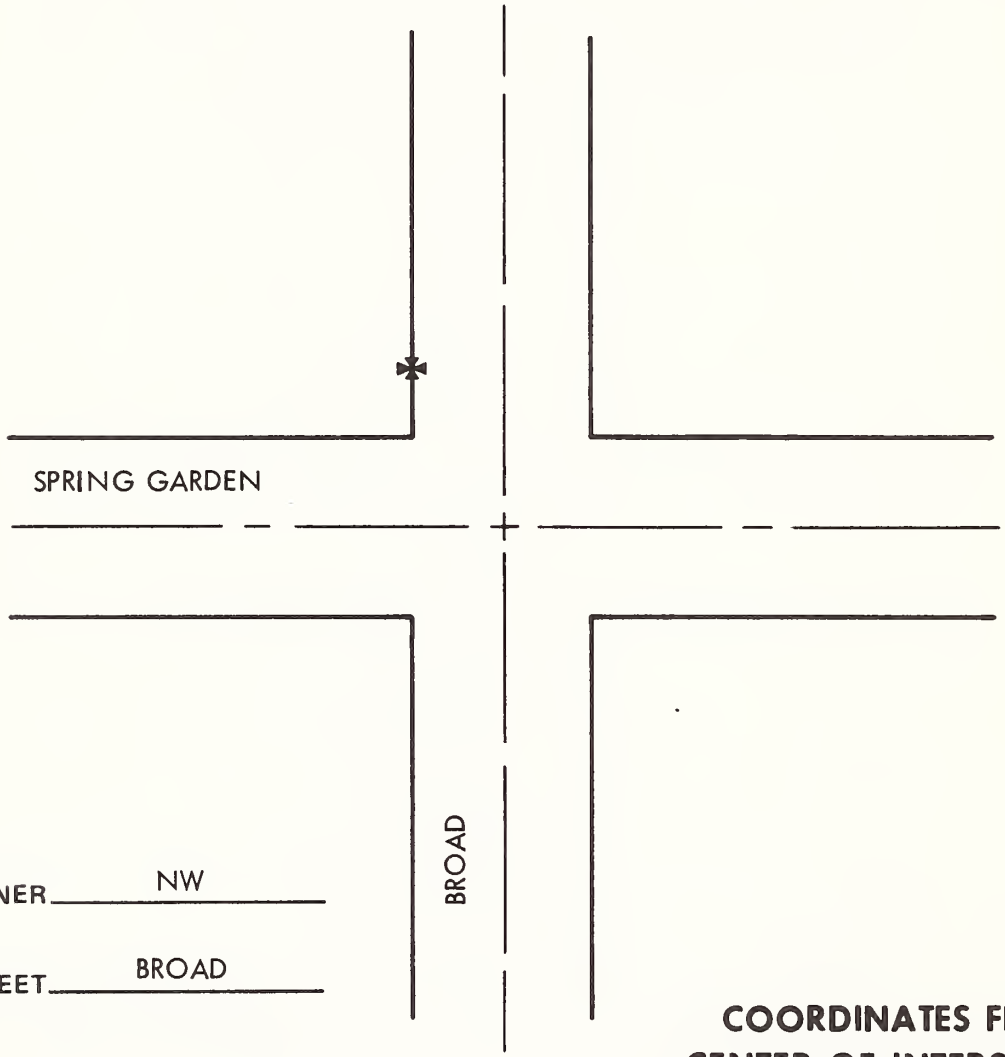
## COORDINATES FROM CENTER OF INTERSECTION

16 FT SOUTH
35 FT EAST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 35





CORNER NW

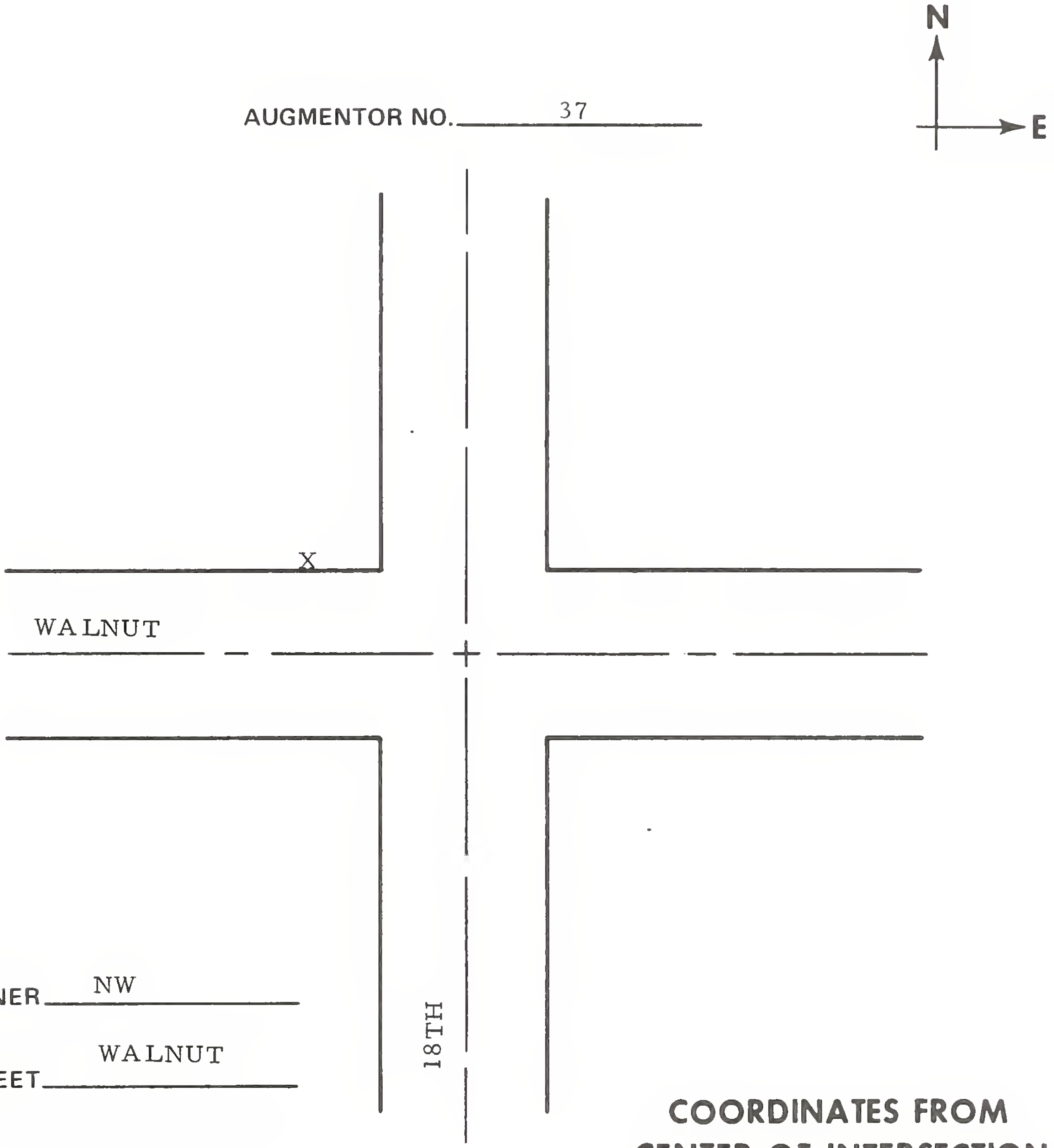
STREET BROAD

**COORDINATES FROM CENTER OF INTERSECTION**

45 FT NORTH
36 FT WEST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 37



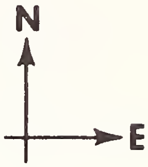
CORNER NW

STREET WALNUT

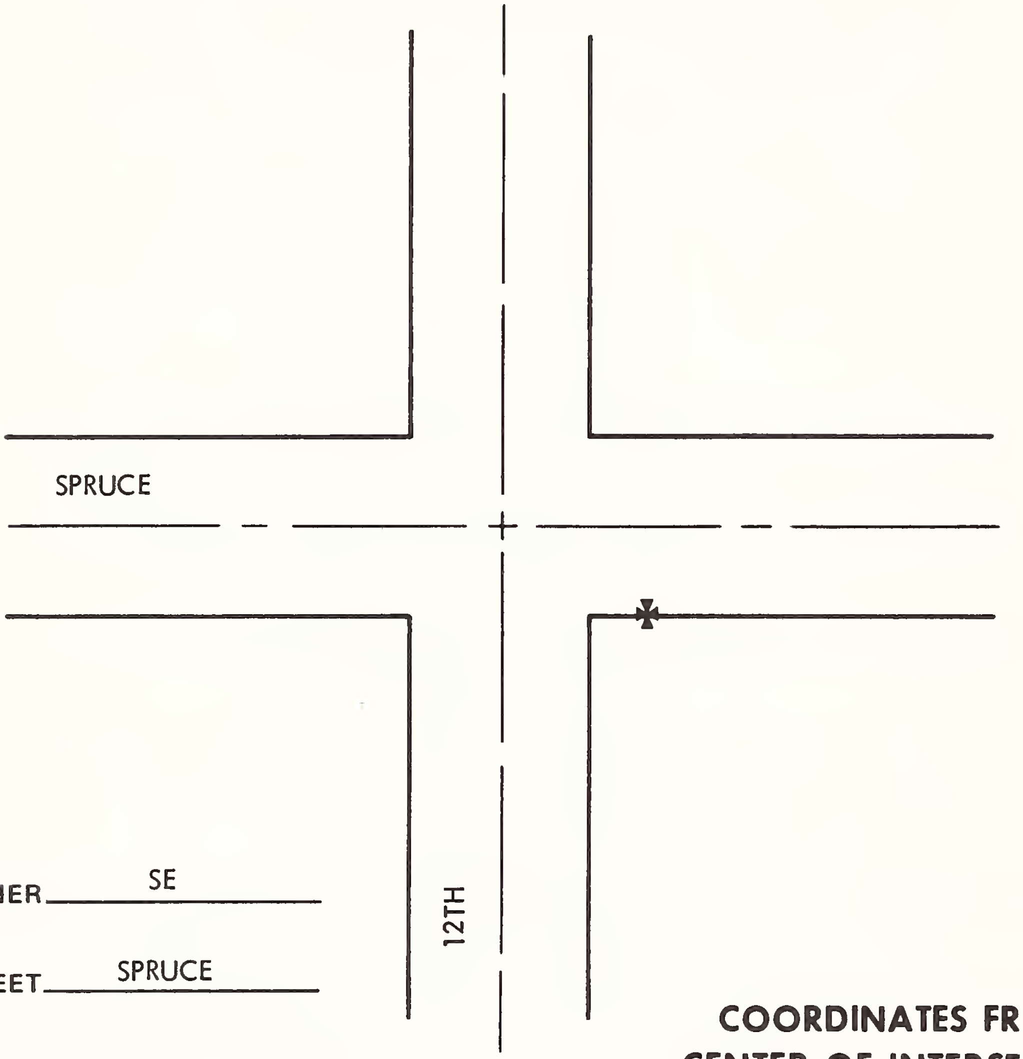
**COORDINATES FROM CENTER OF INTERSECTION**

15 FT NORTH
29 FT WEST

# AUGMENTOR LOCATION DESCRIPTION



AUGMENTOR NO. 40



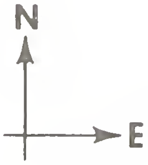
CORNER SE

STREET SPRUCE

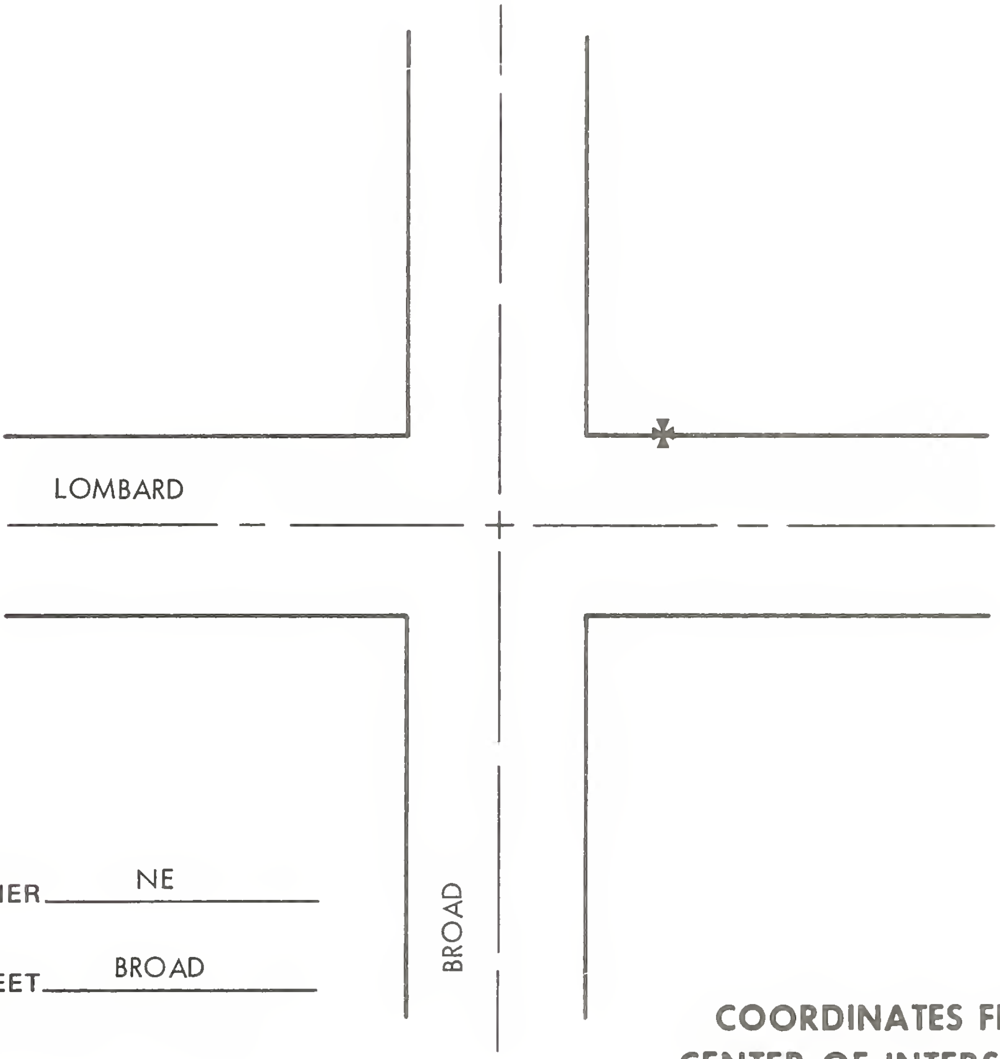
**COORDINATES FROM CENTER OF INTERSECTION**

15 FT SOUTH
24 FT EAST

# AUGMENTOR LOCATION DESCRIPTION



AUGMENTOR NO. 42



CORNER NE

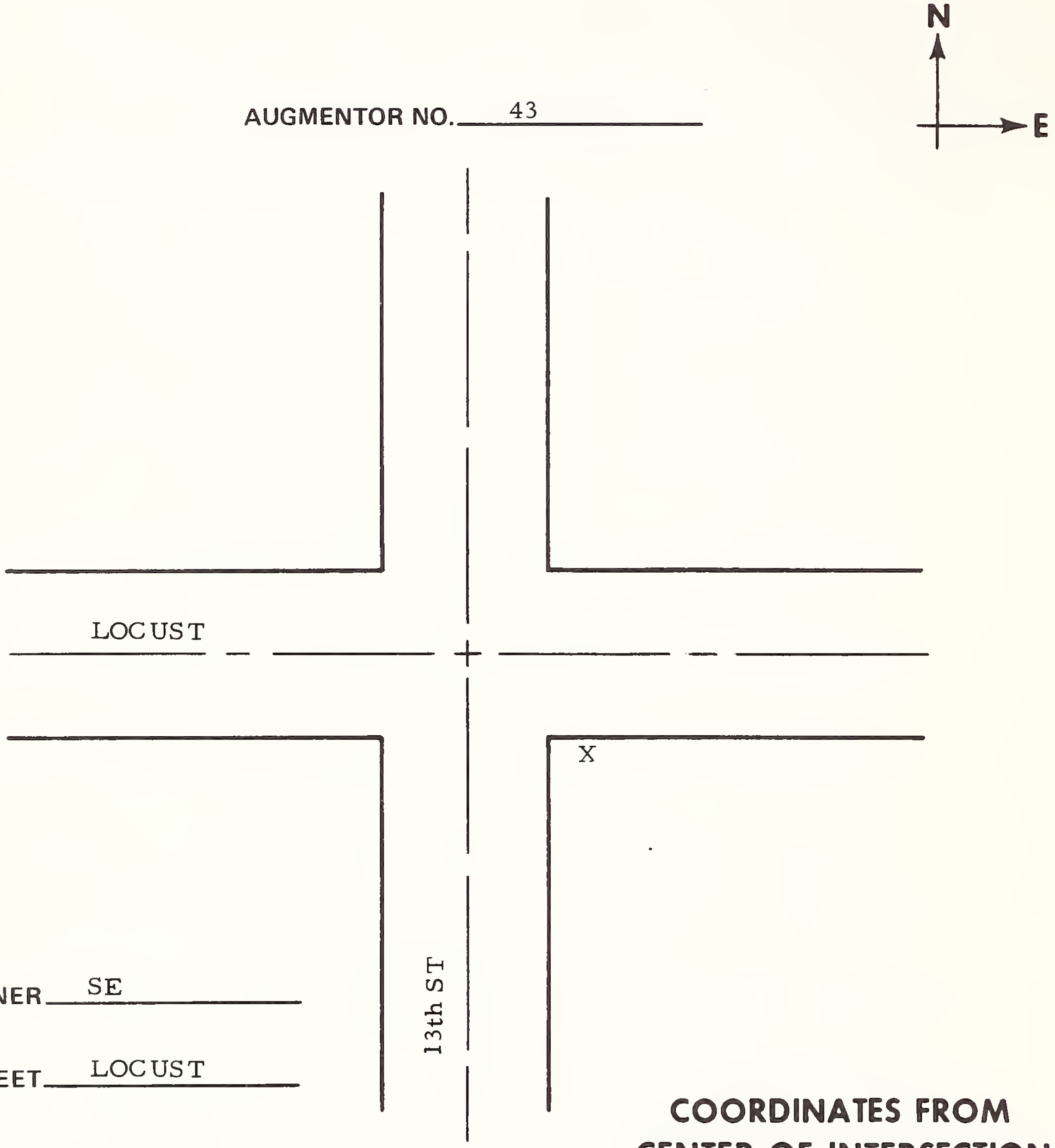
STREET BROAD

**COORDINATES FROM CENTER OF INTERSECTION**

24 FT NORTH
37 FT EAST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 43



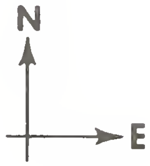
CORNER SE

STREET LOCUST

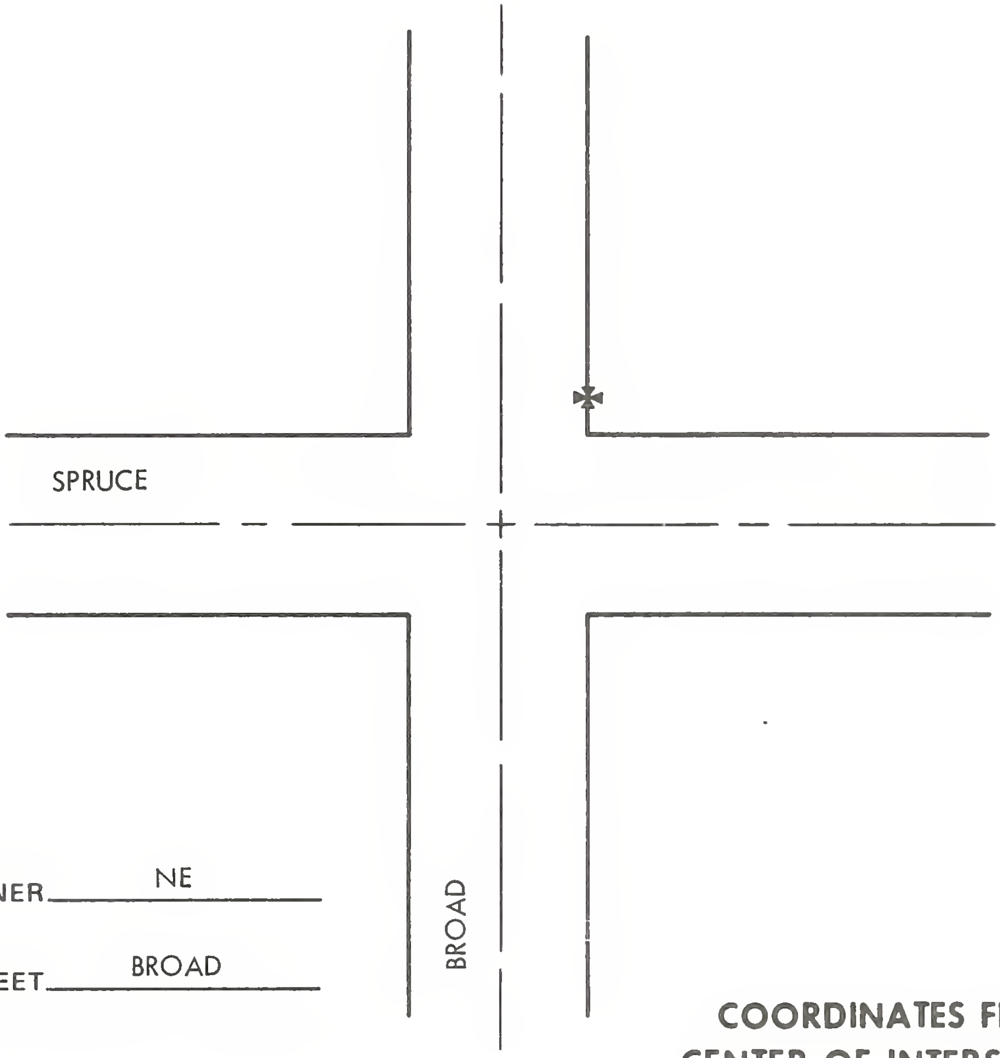
**COORDINATES FROM CENTER OF INTERSECTION**

16 FT SOUTH
26 FT EAST

# AUGMENTOR LOCATION DESCRIPTION



AUGMENTOR NO. 44



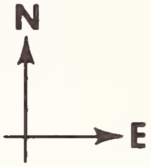
CORNER NE

STREET BROAD

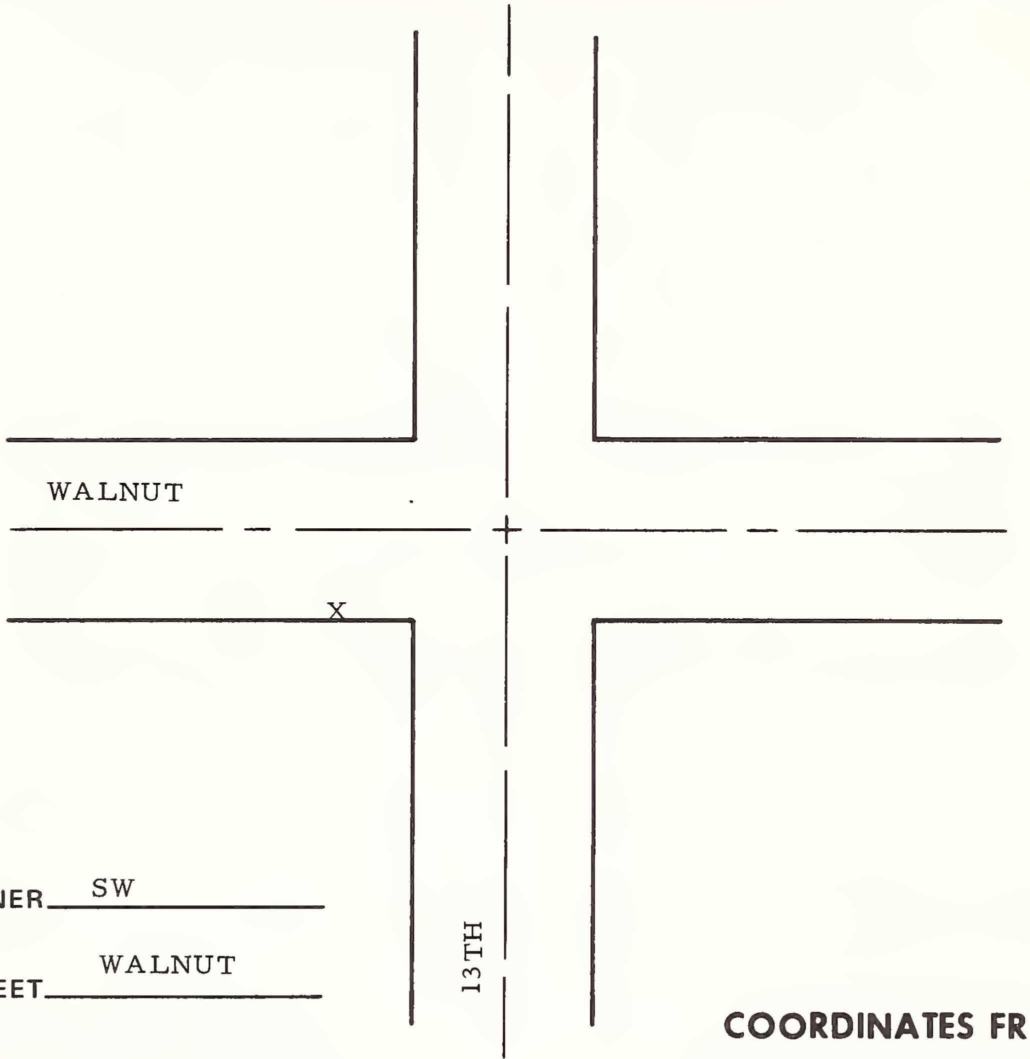
**COORDINATES FROM CENTER OF INTERSECTION**

34 FT NORTH
39 FT EAST

# AUGMENTOR LOCATION DESCRIPTION



AUGMENTOR NO. 45



CORNER SW

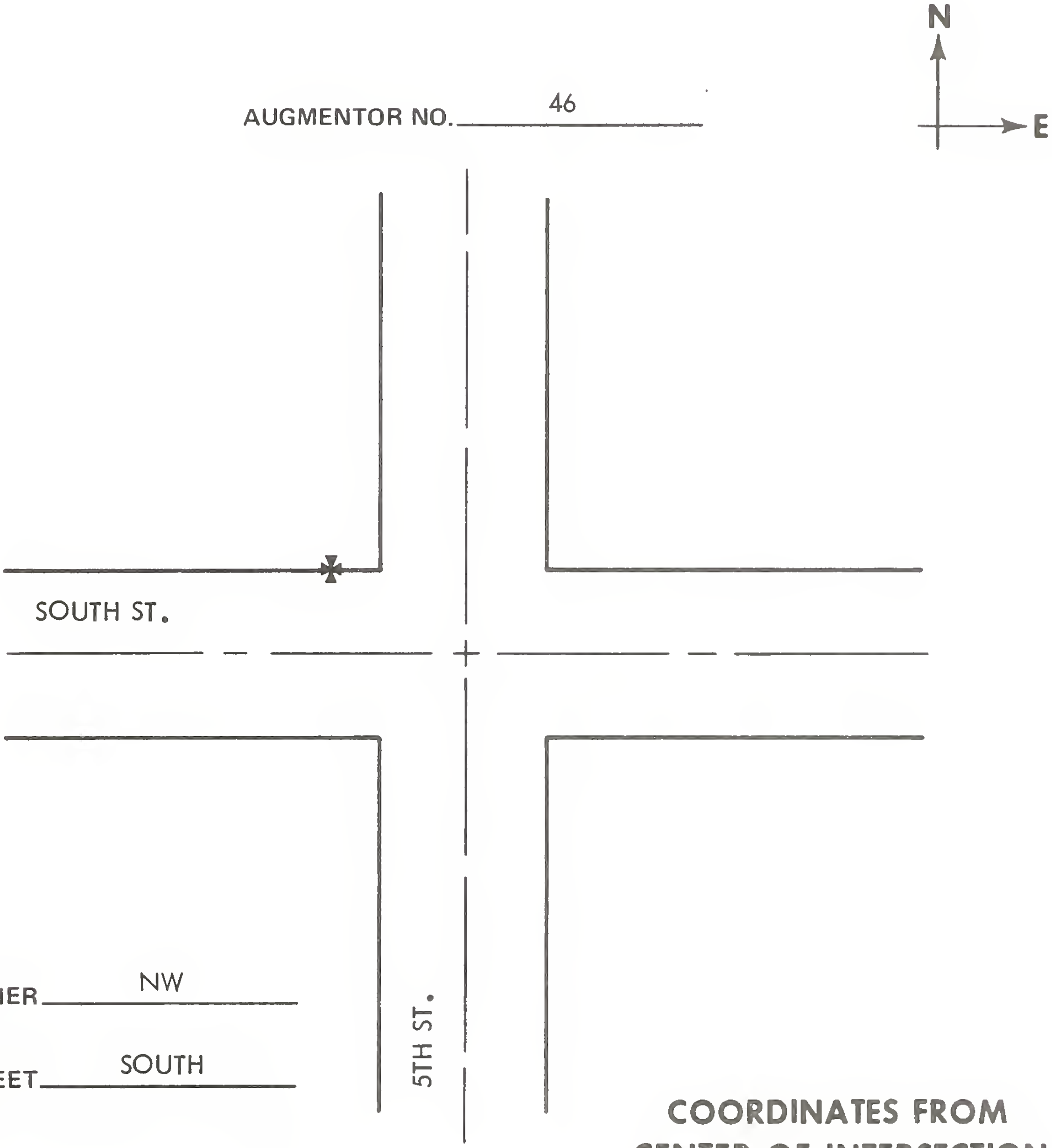
STREET WALNUT

**COORDINATES FROM CENTER OF INTERSECTION**

15 FT SOUTH
25 FT WEST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 46



CORNER NW

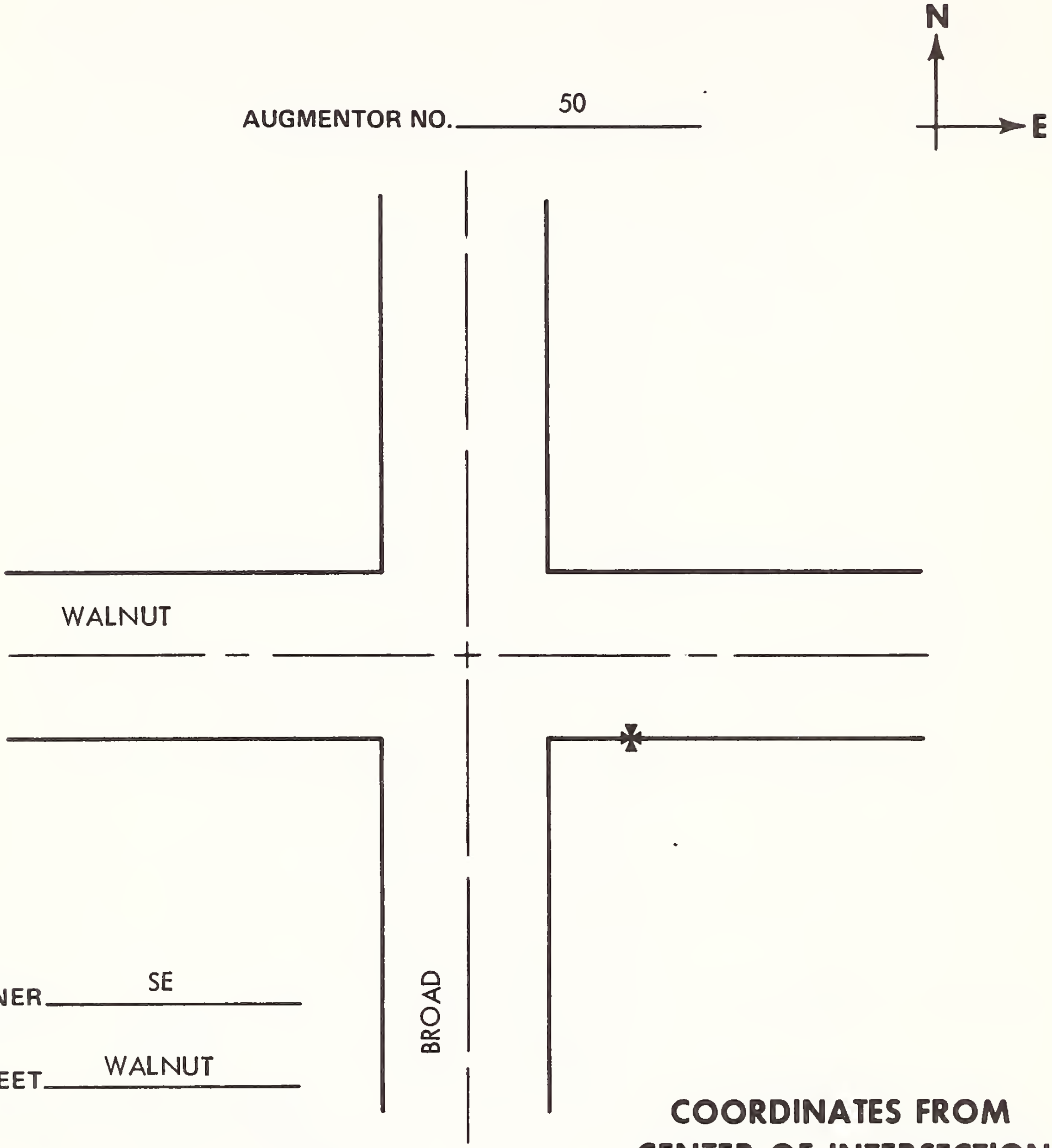
STREET SOUTH

**COORDINATES FROM CENTER OF INTERSECTION**

16 FT NORTH
23 FT WEST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 50



CORNER SE

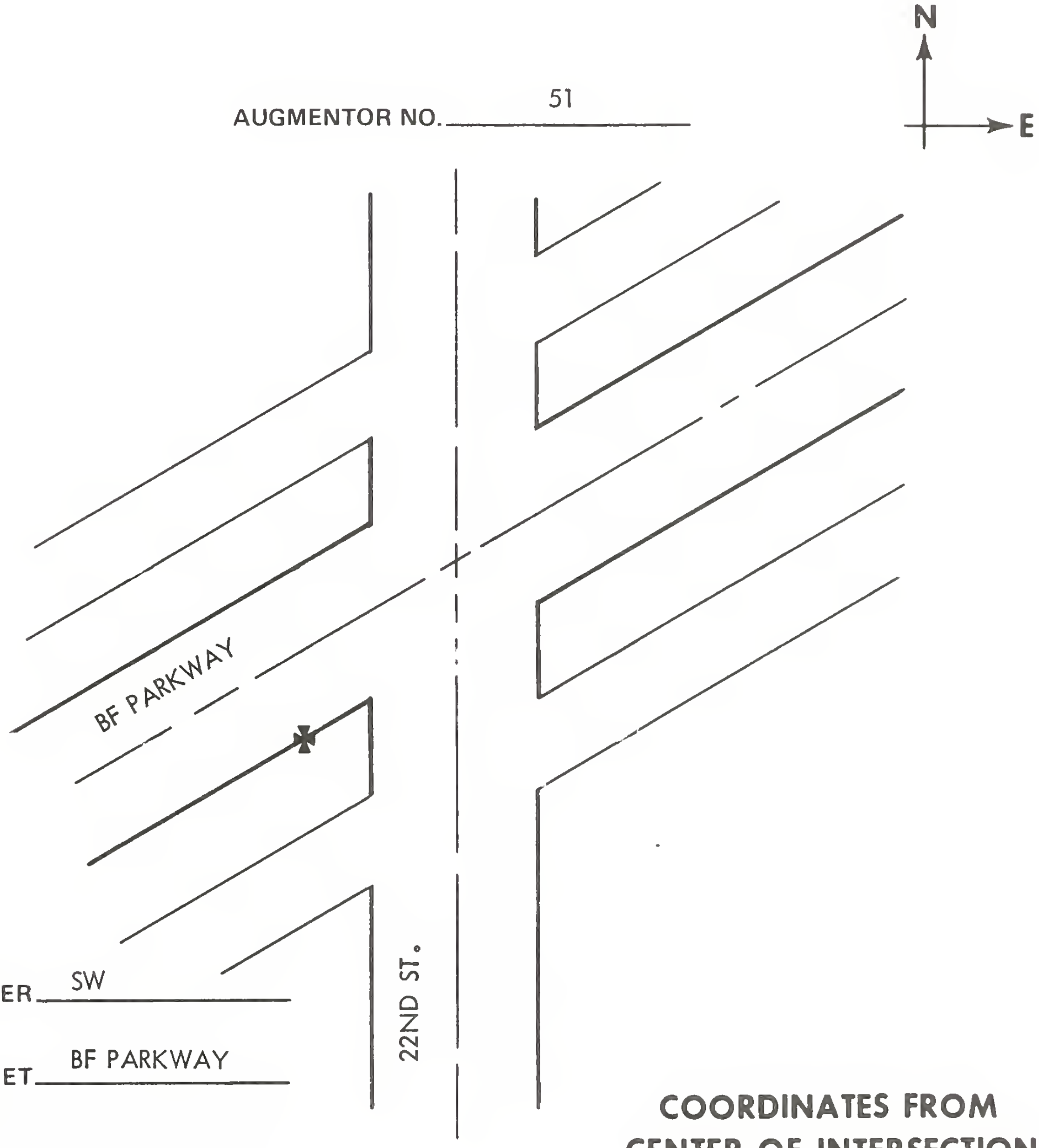
STREET WALNUT

**COORDINATES FROM CENTER OF INTERSECTION**

15 FT SOUTH
59 FT WEST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 51



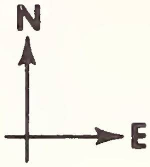
CORNER SW

STREET BF PARKWAY

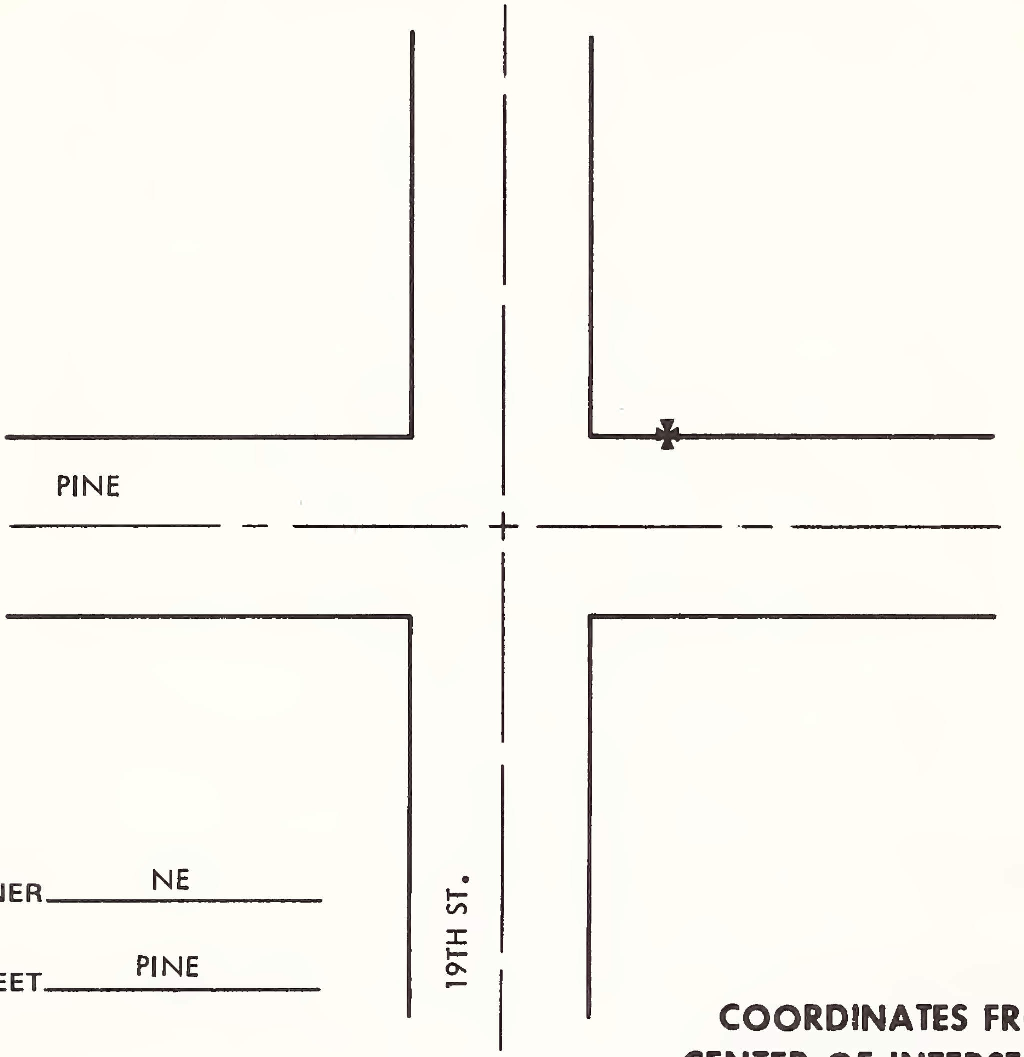
**COORDINATES FROM CENTER OF INTERSECTION**

45 FT SOUTH
43.5 FT WEST

# AUGMENTOR LOCATION DESCRIPTION



AUGMENTOR NO. 53



CORNER NE

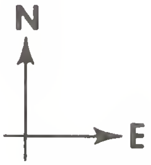
STREET PINE

## COORDINATES FROM CENTER OF INTERSECTION

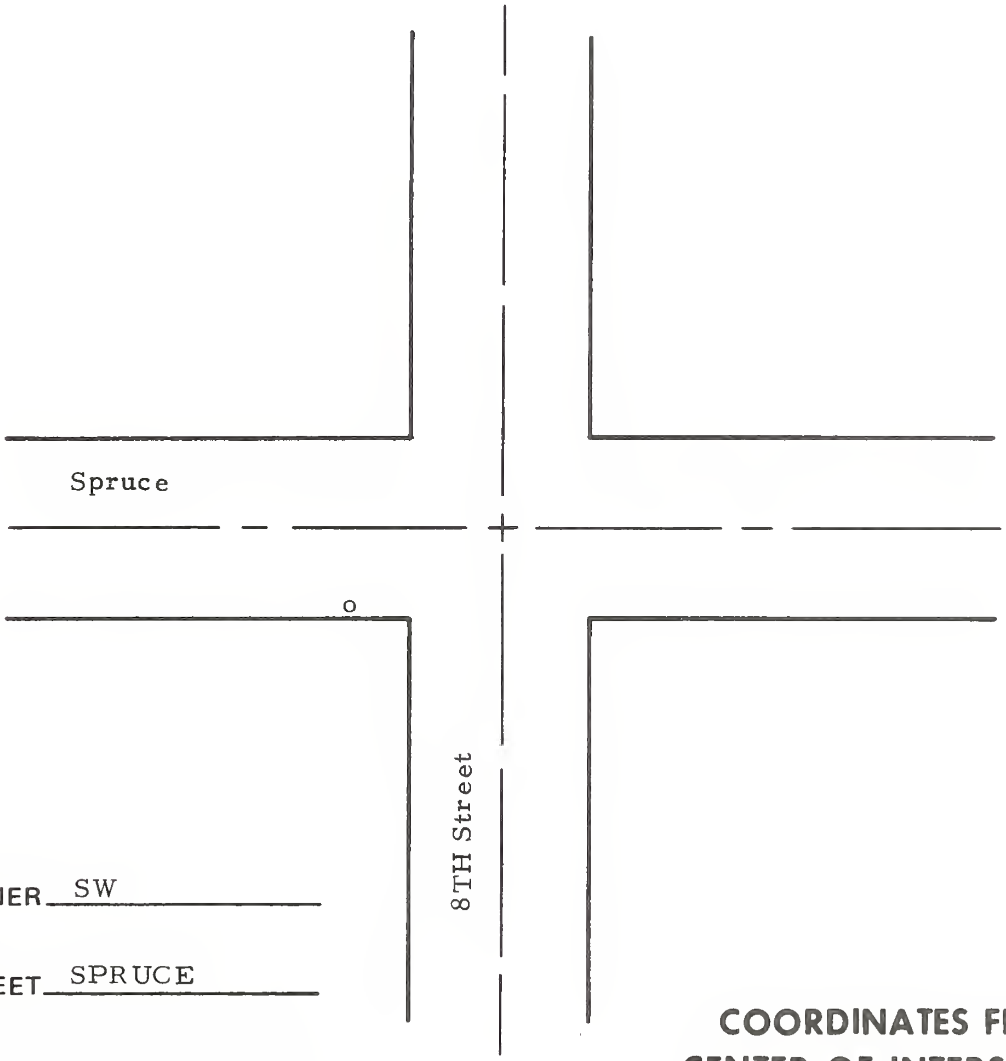
16 FT NORTH
33 FT EAST

Revised 1/7/77

# AUGMENTOR LOCATION DESCRIPTION



AUGMENTOR NO. 54



CORNER SW

STREET SPRUCE

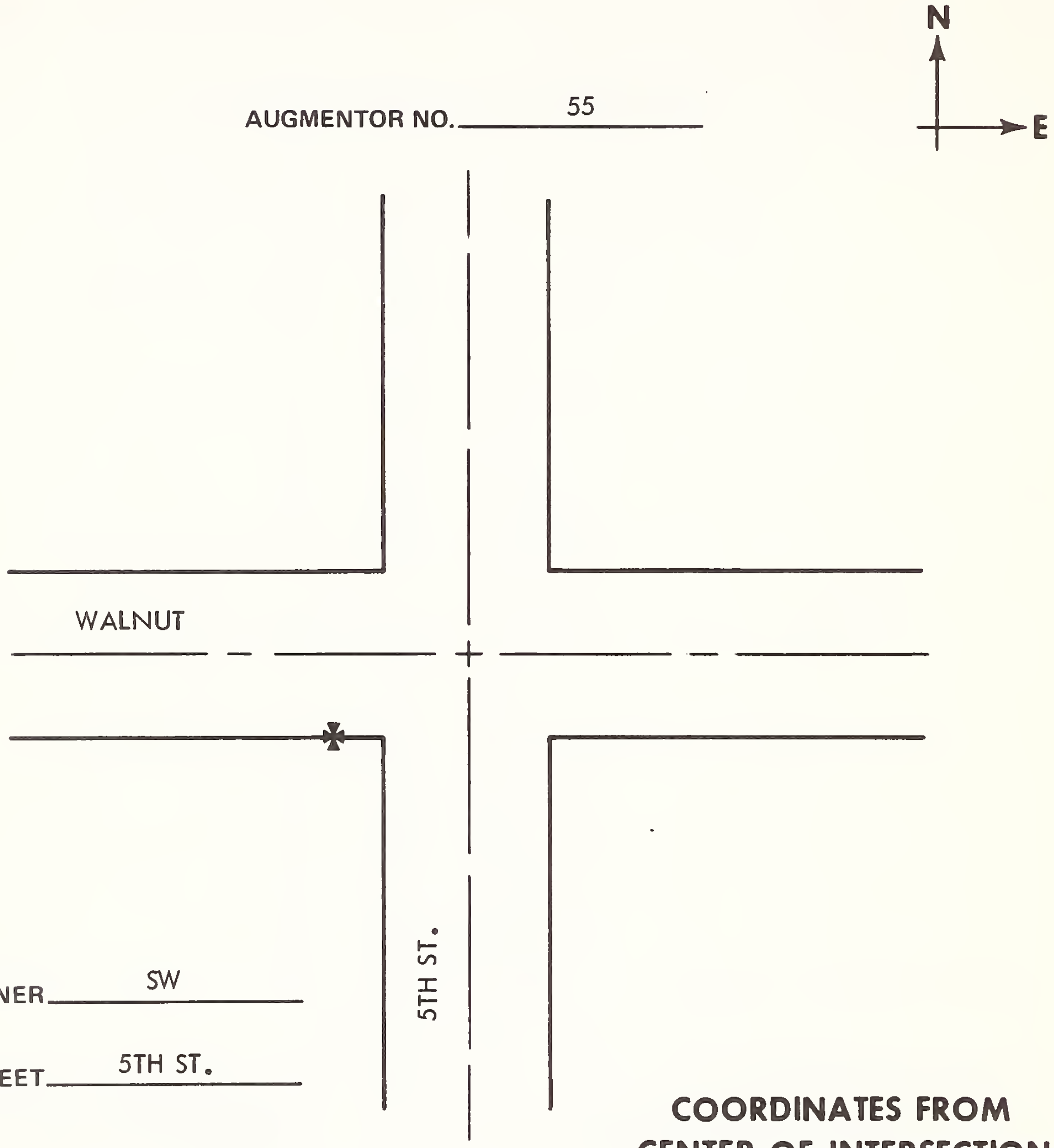
## COORDINATES FROM CENTER OF INTERSECTION

16 FT SOUTH

25 FT WEST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 55



CORNER SW

STREET 5TH ST.

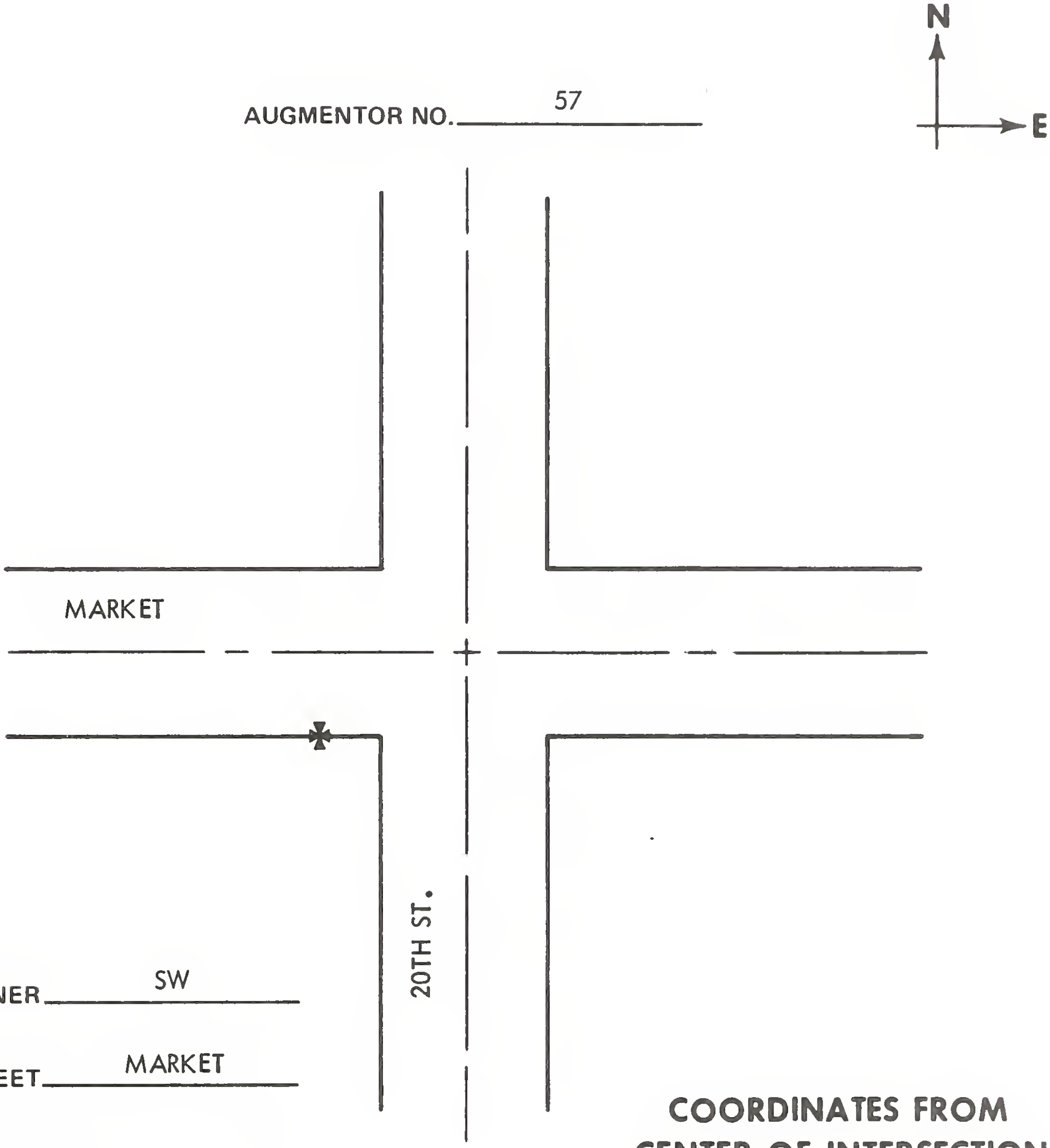
**COORDINATES FROM CENTER OF INTERSECTION**

27 FT SOUTH

16 FT WEST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 57



CORNER SW

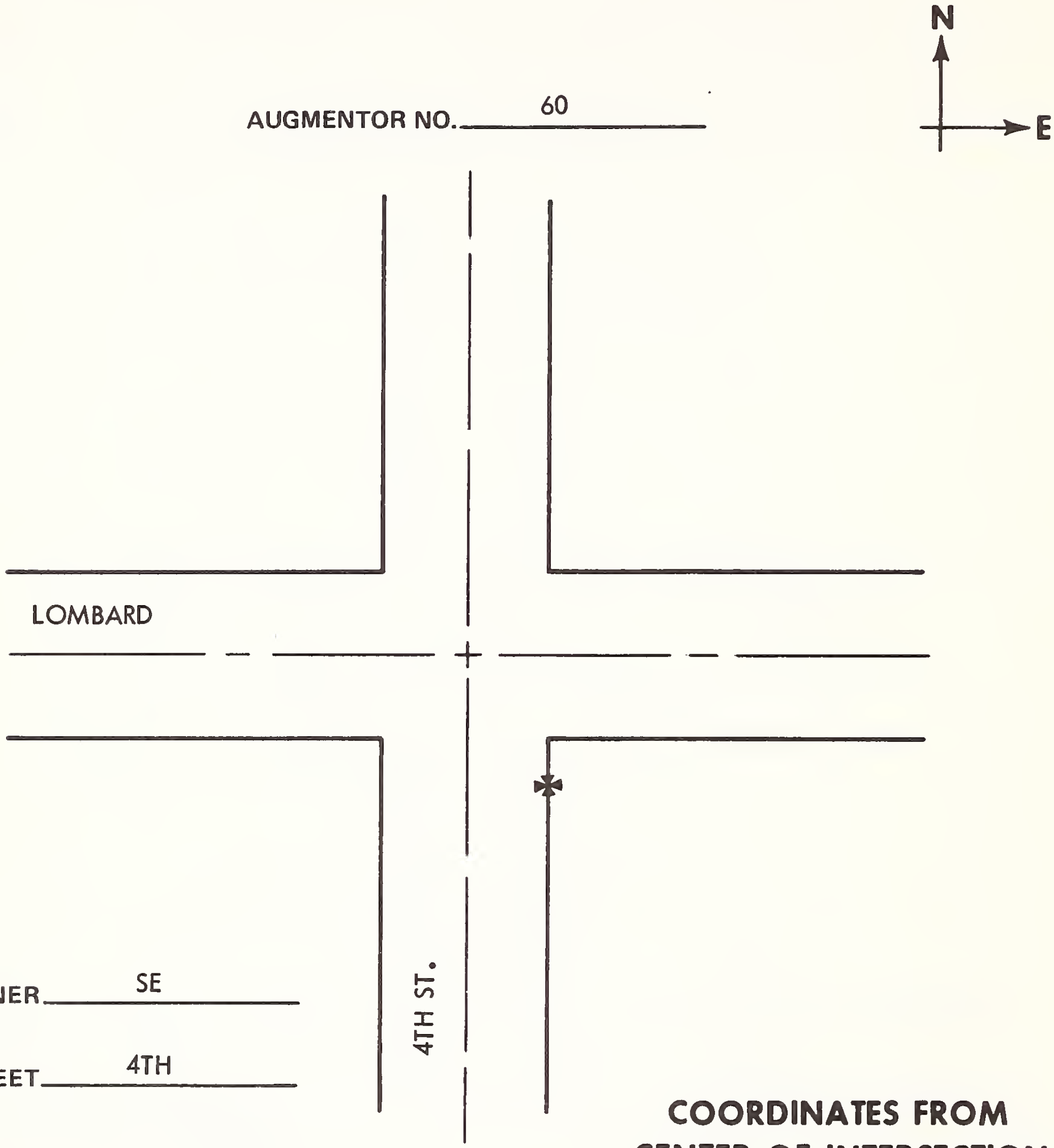
STREET MARKET

**COORDINATES FROM CENTER OF INTERSECTION**

33 FT SOUTH
27 FT WEST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 60



CORNER SE

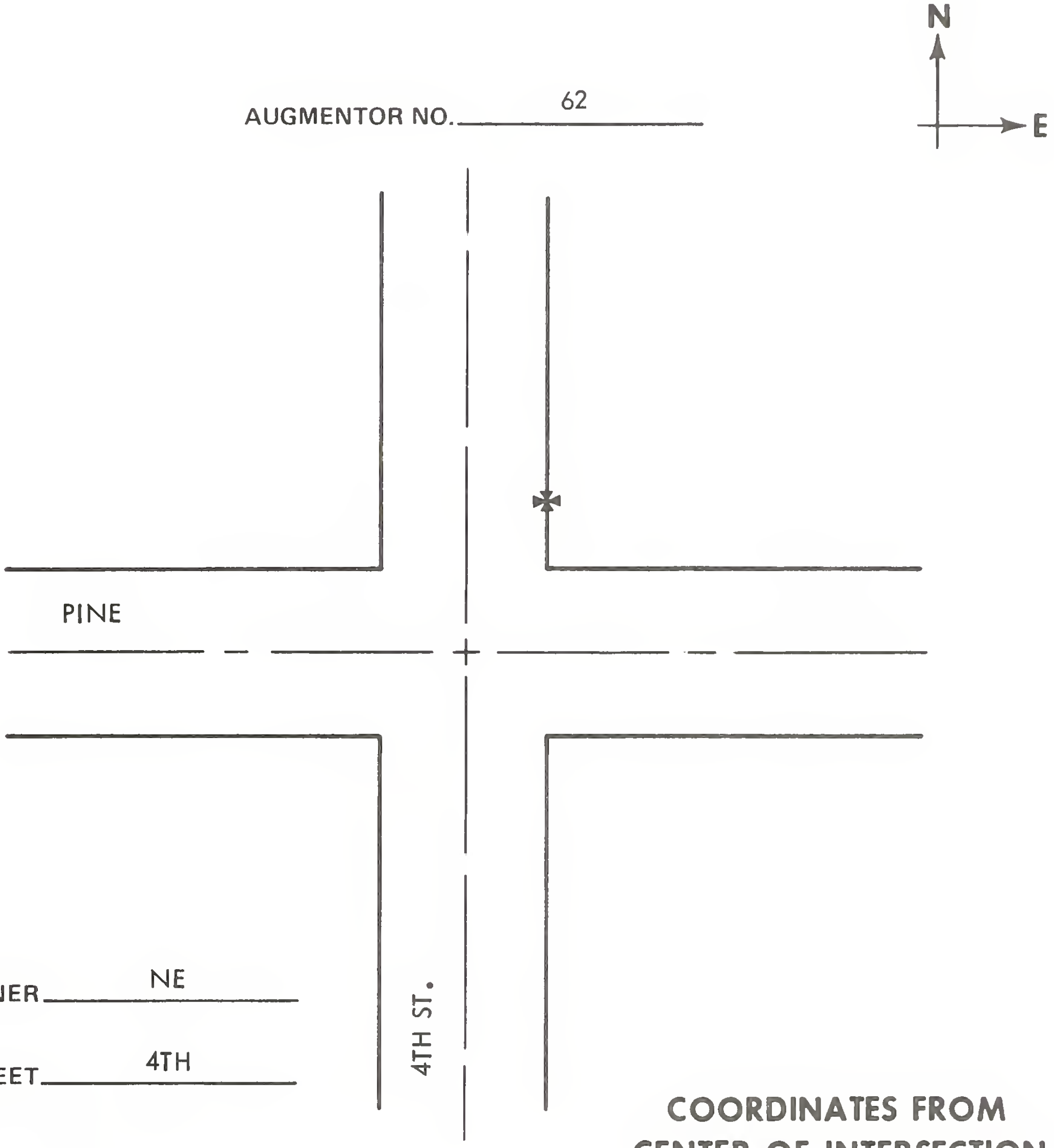
STREET 4TH

**COORDINATES FROM CENTER OF INTERSECTION**

25 FT SOUTH
14 FT EAST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 62



CORNER NE

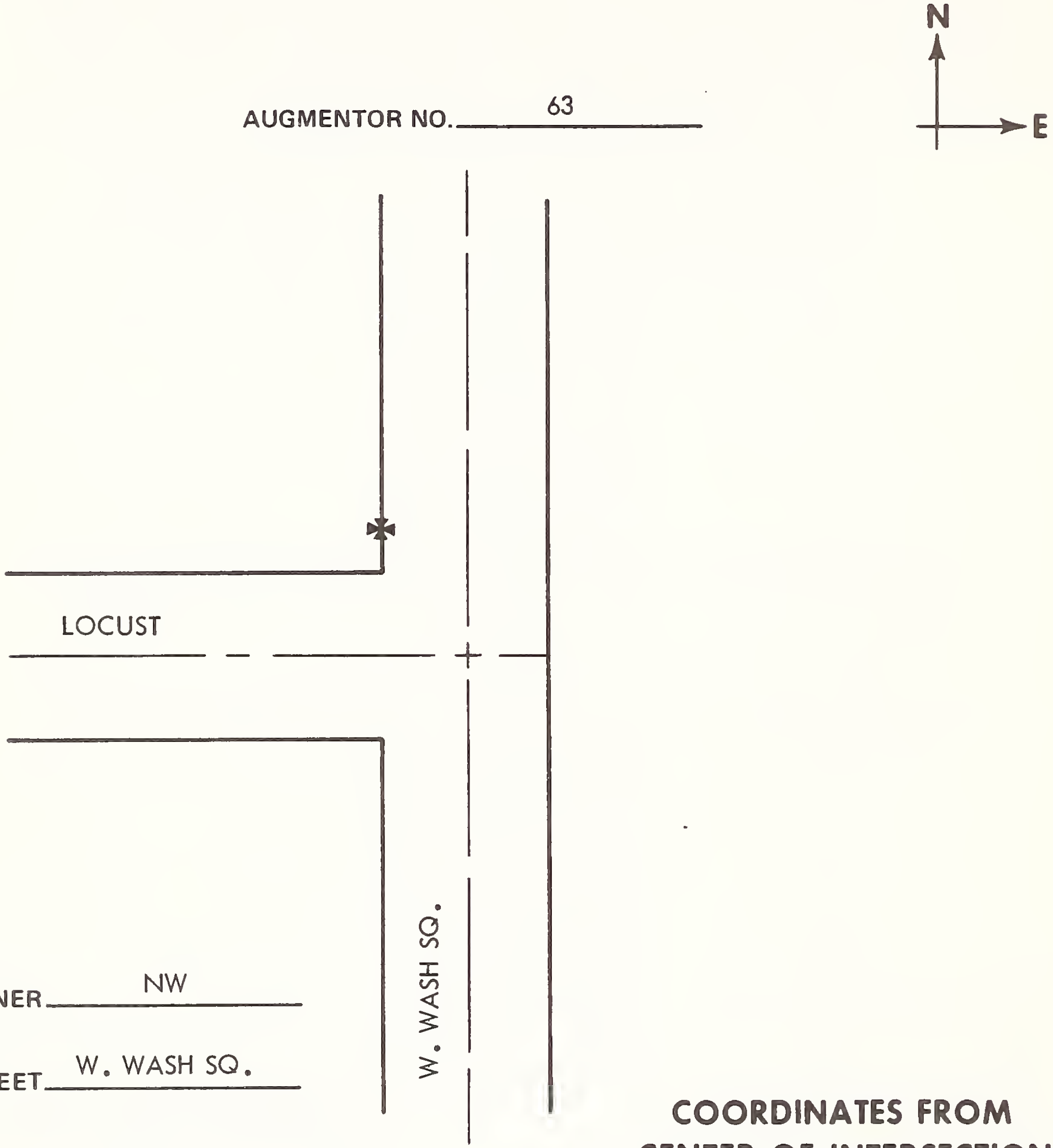
STREET 4TH

**COORDINATES FROM CENTER OF INTERSECTION**

30 FT NORTH
15 FT EAST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 63



CORNER NW

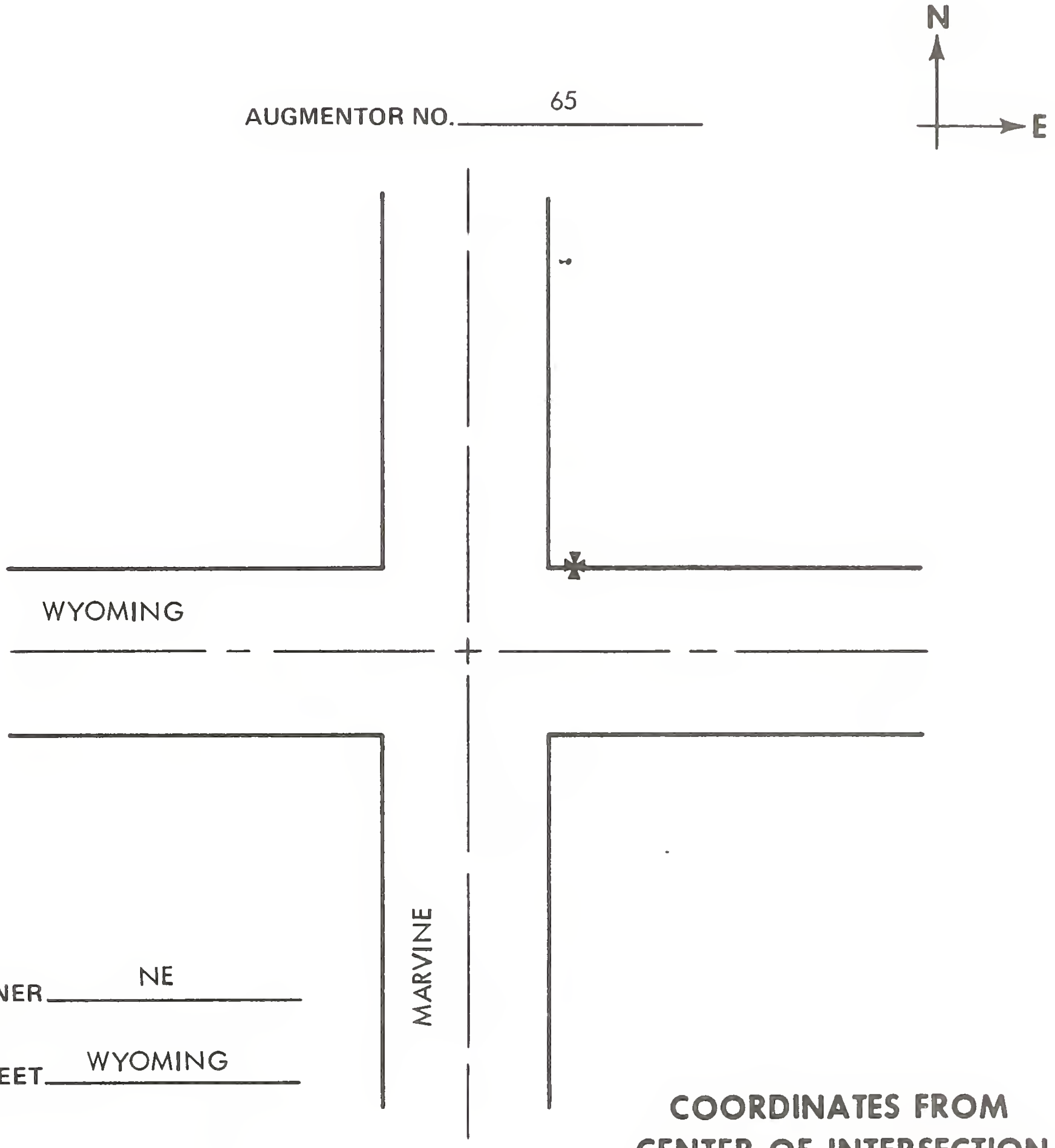
STREET W. WASH SQ.

**COORDINATES FROM CENTER OF INTERSECTION**

26 FT NORTH
16 FT WEST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 65



CORNER NE

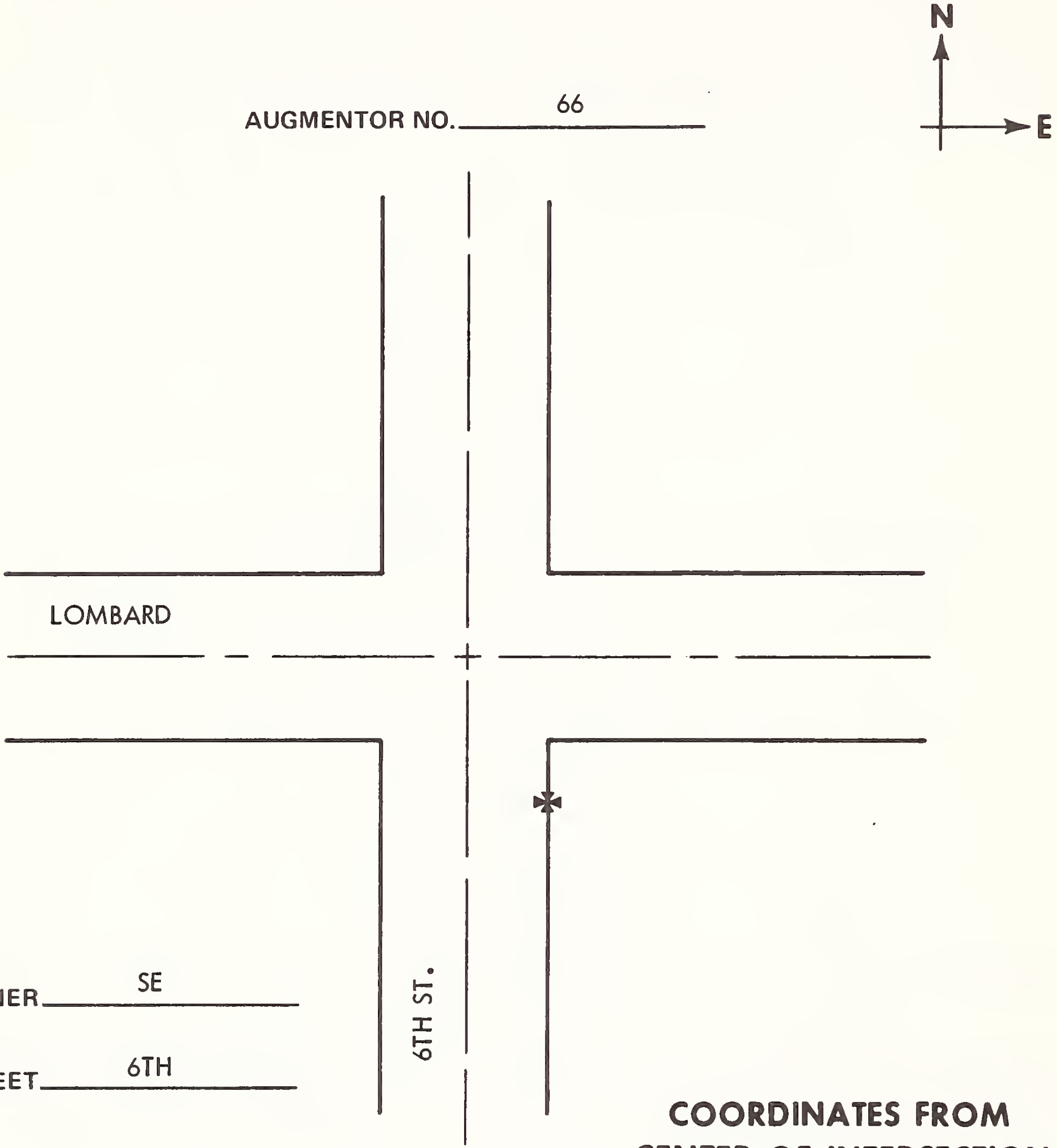
STREET WYOMING

**COORDINATES FROM CENTER OF INTERSECTION**

30 FT NORTH
24 FT EAST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 66



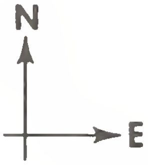
CORNER SE

STREET 6TH

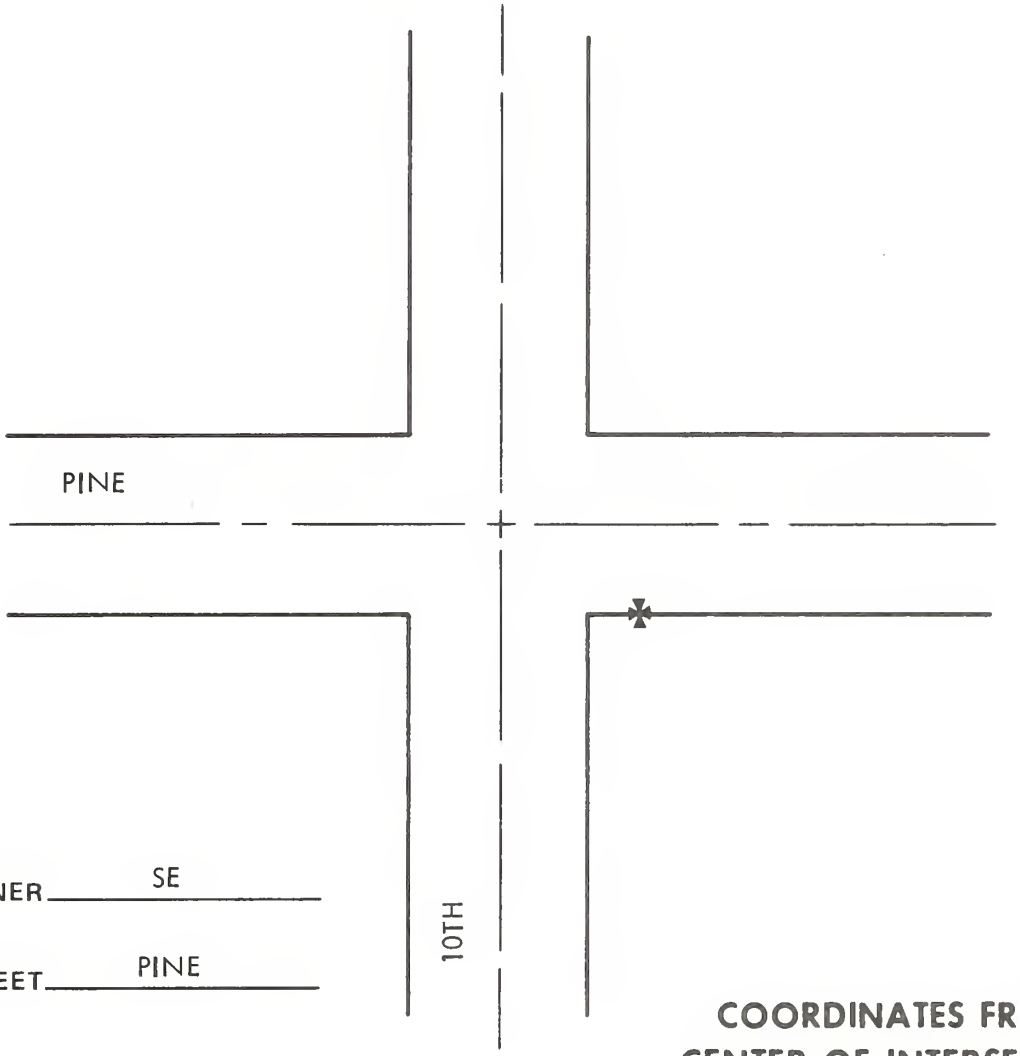
**COORDINATES FROM CENTER OF INTERSECTION**

27 FT SOUTH
15 FT EAST

# AUGMENTOR LOCATION DESCRIPTION



AUGMENTOR NO. 67



CORNER SE

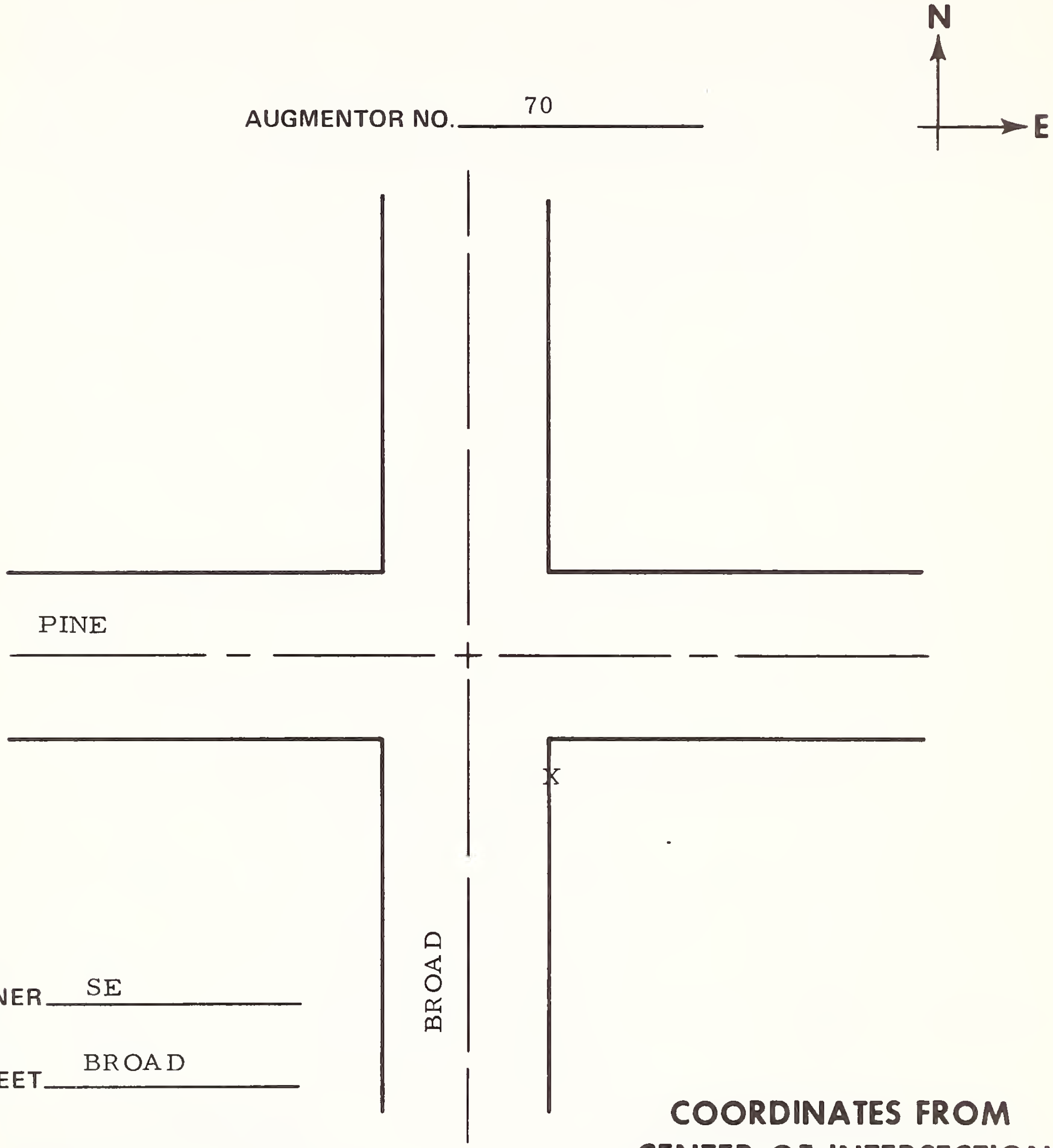
STREET PINE

**COORDINATES FROM CENTER OF INTERSECTION**

14 FT SOUTH
23 FT EAST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 70



CORNER SE

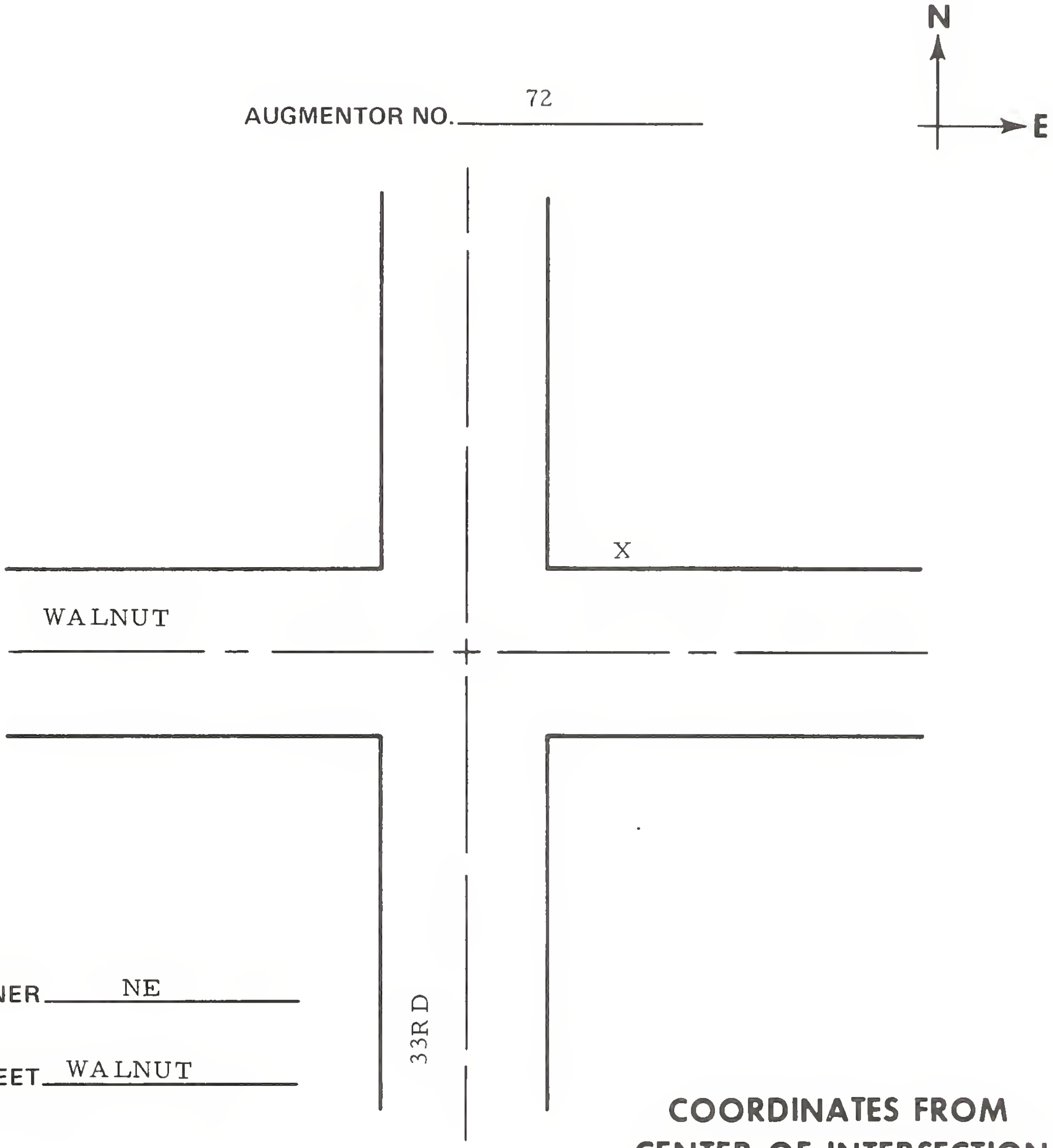
STREET BROAD

**COORDINATES FROM CENTER OF INTERSECTION**

37 FT SOUTH
37 FT EAST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 72



CORNER NE

STREET WALNUT

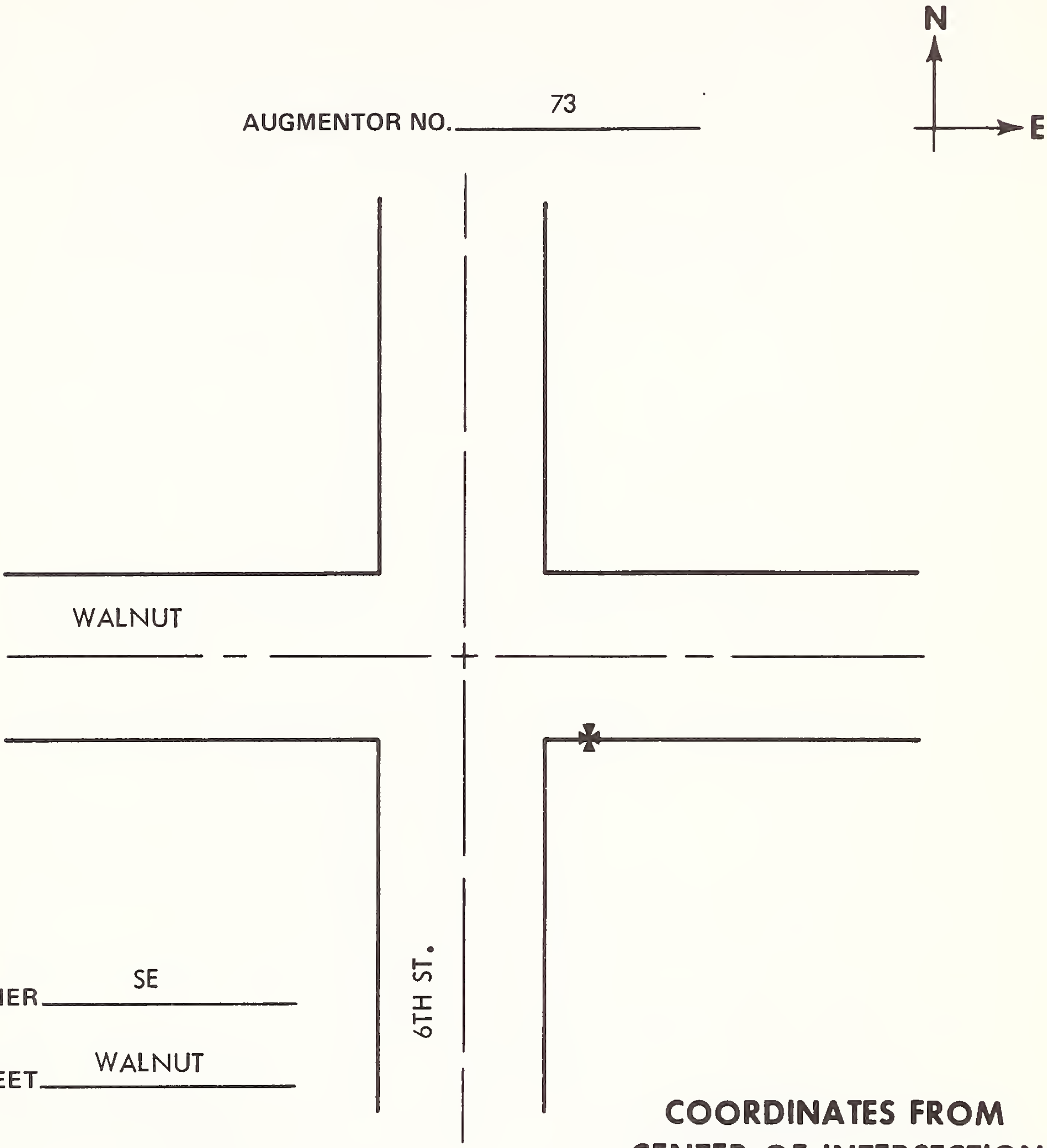
## COORDINATES FROM CENTER OF INTERSECTION

25 FT NORTH

39 FT EAST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 73



CORNER SE

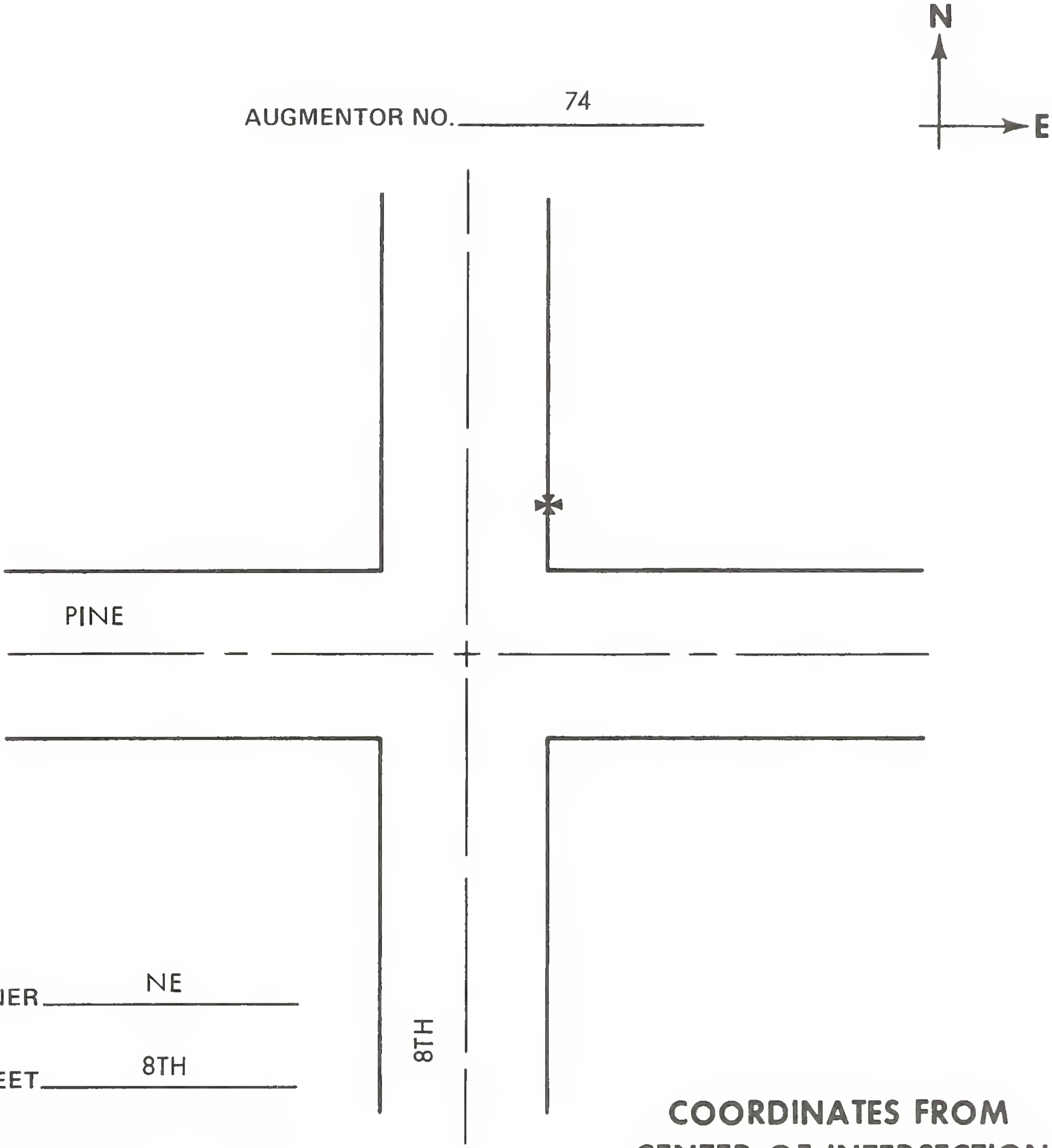
STREET WALNUT

**COORDINATES FROM CENTER OF INTERSECTION**

16 FT SOUTH
28 FT EAST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 74



CORNER NE

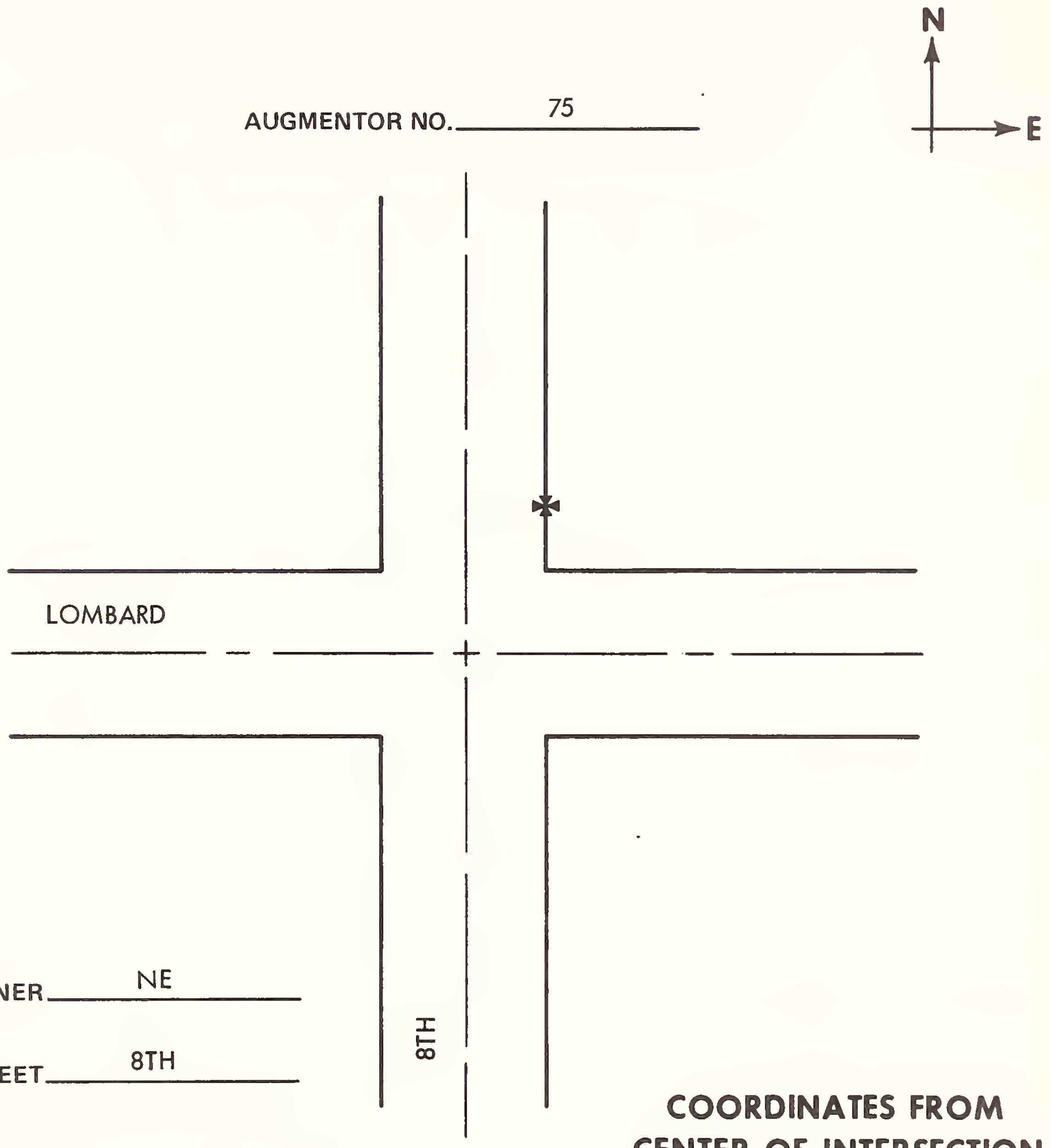
STREET 8TH

**COORDINATES FROM CENTER OF INTERSECTION**

30 FT NORTH
14 FT EAST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 75



CORNER NE

STREET 8TH

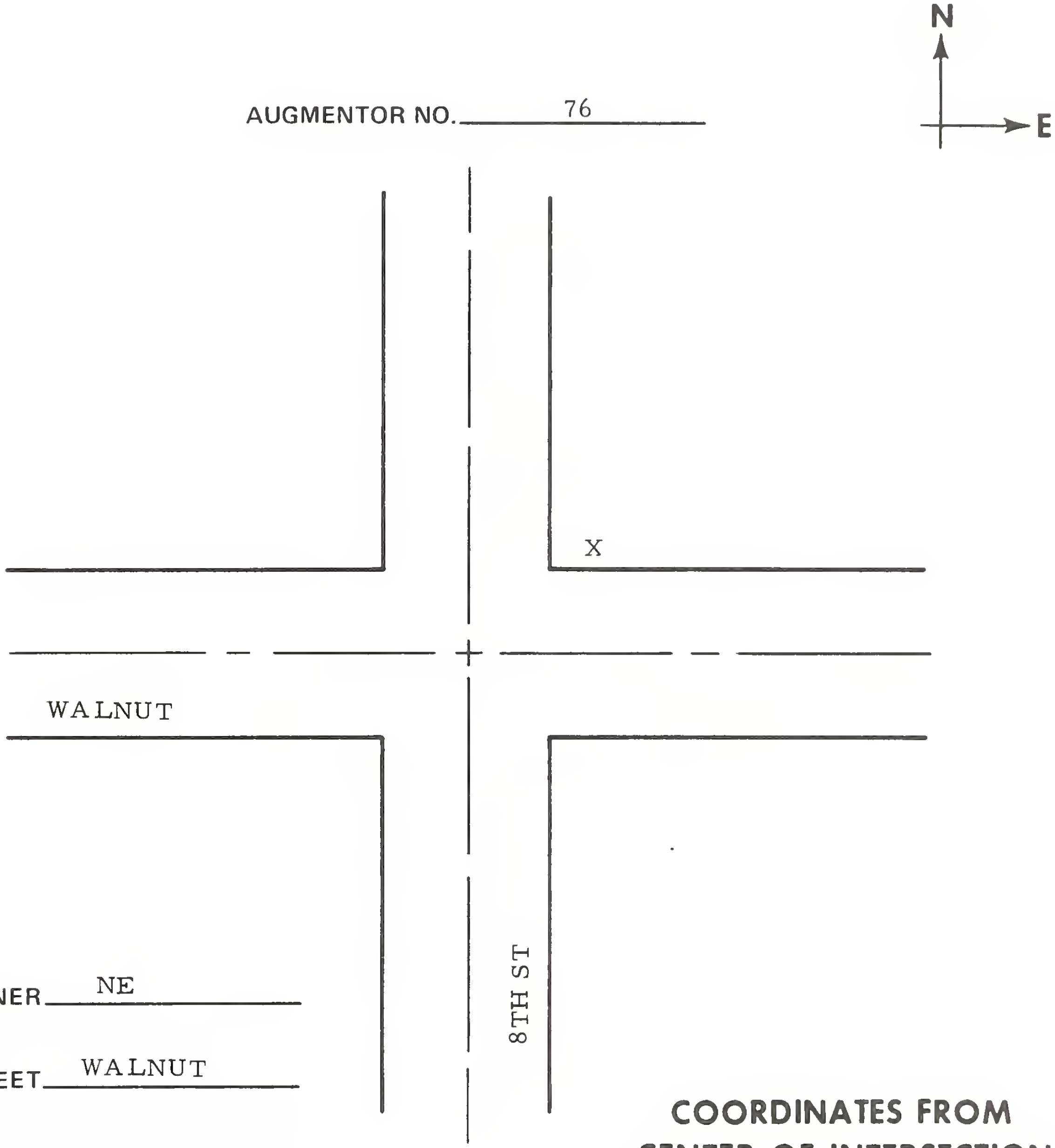
**COORDINATES FROM CENTER OF INTERSECTION**

29 FT NORTH
15 FT EAST

Revised 1/7/77

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 76



CORNER NE

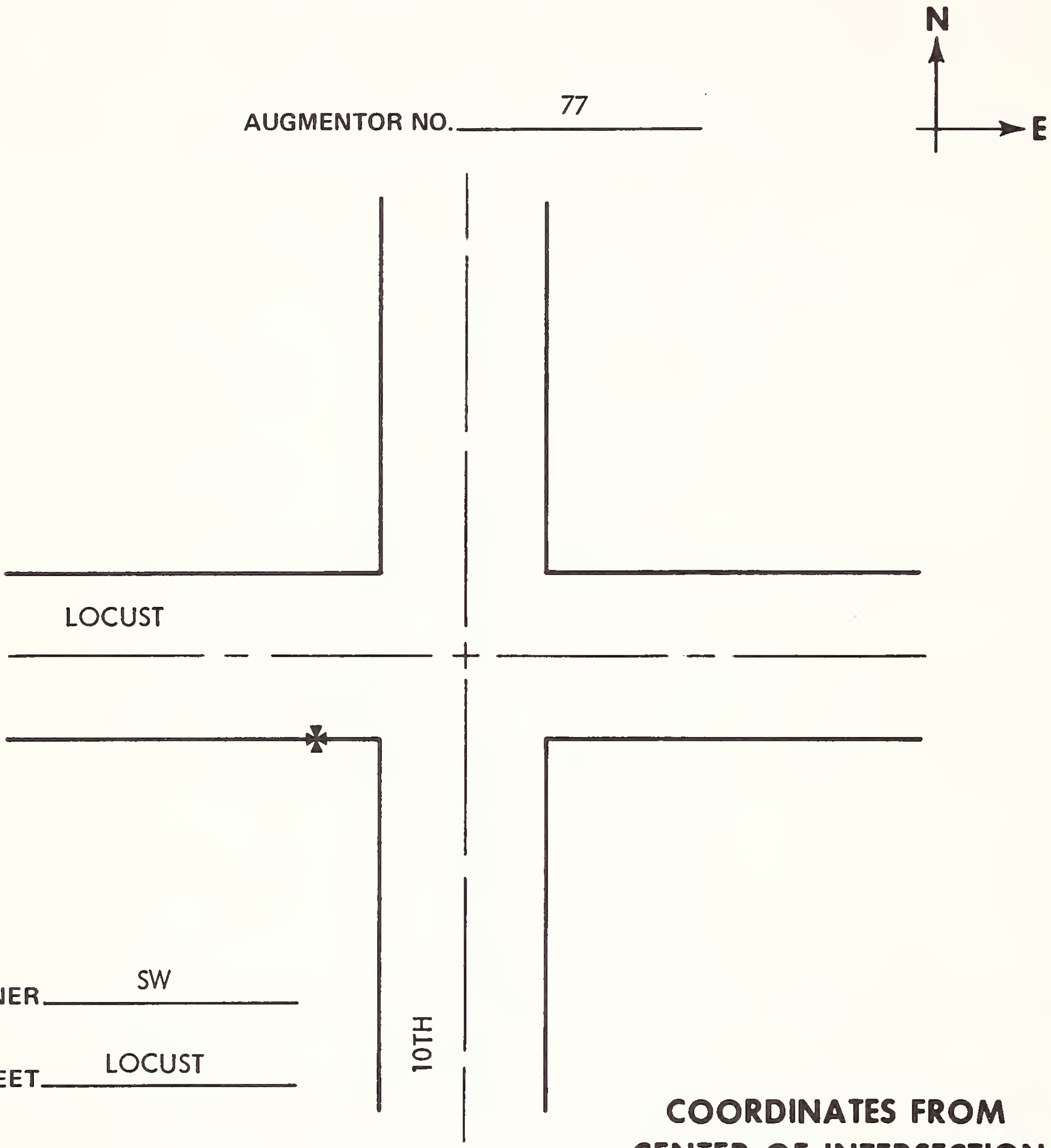
STREET WALNUT

## COORDINATES FROM CENTER OF INTERSECTION

15 FT NORTH
24 FT EAST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 77



CORNER SW

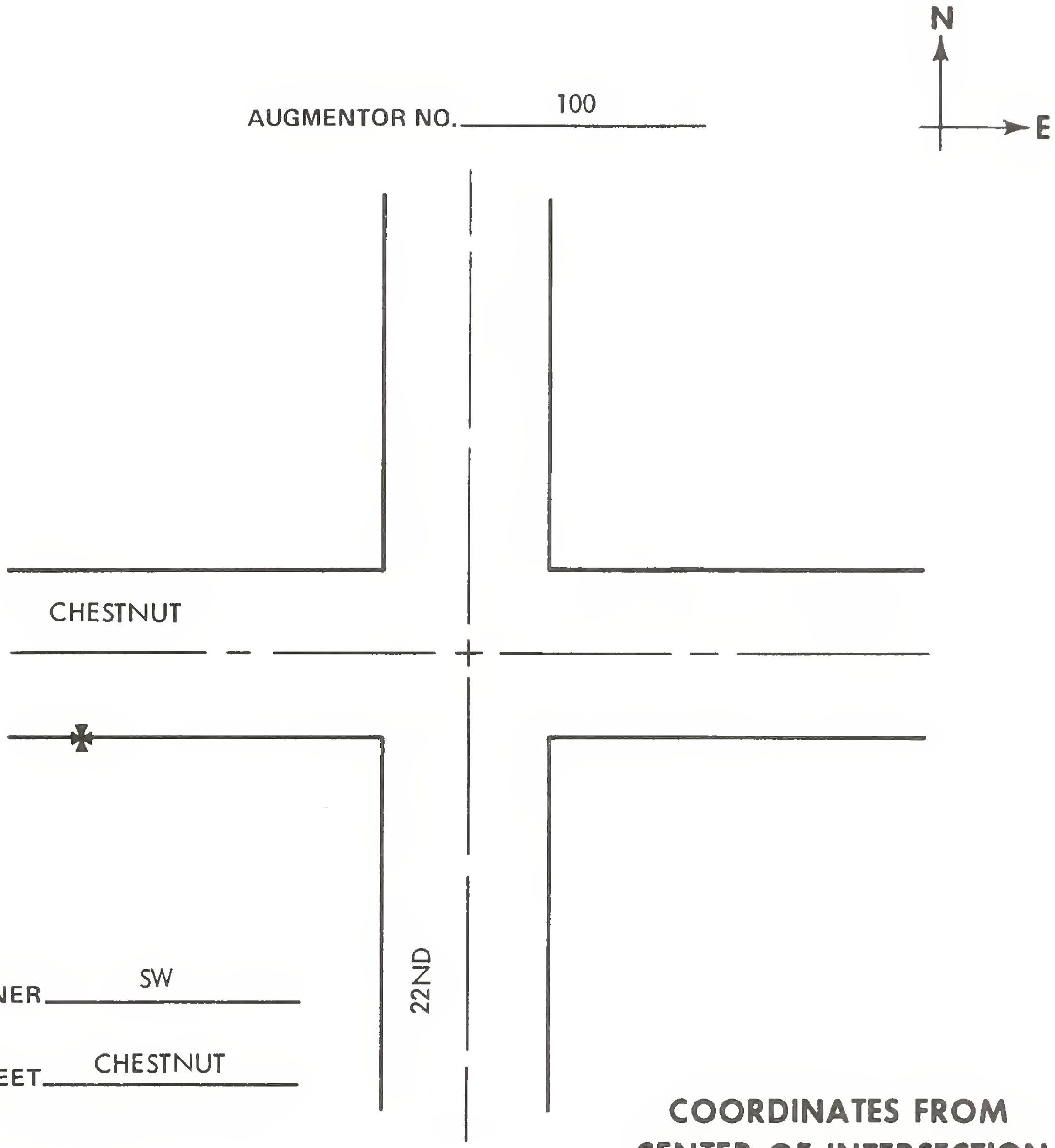
STREET LOCUST

**COORDINATES FROM CENTER OF INTERSECTION**

15 FT SOUTH
26 FT WEST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 100



CORNER SW

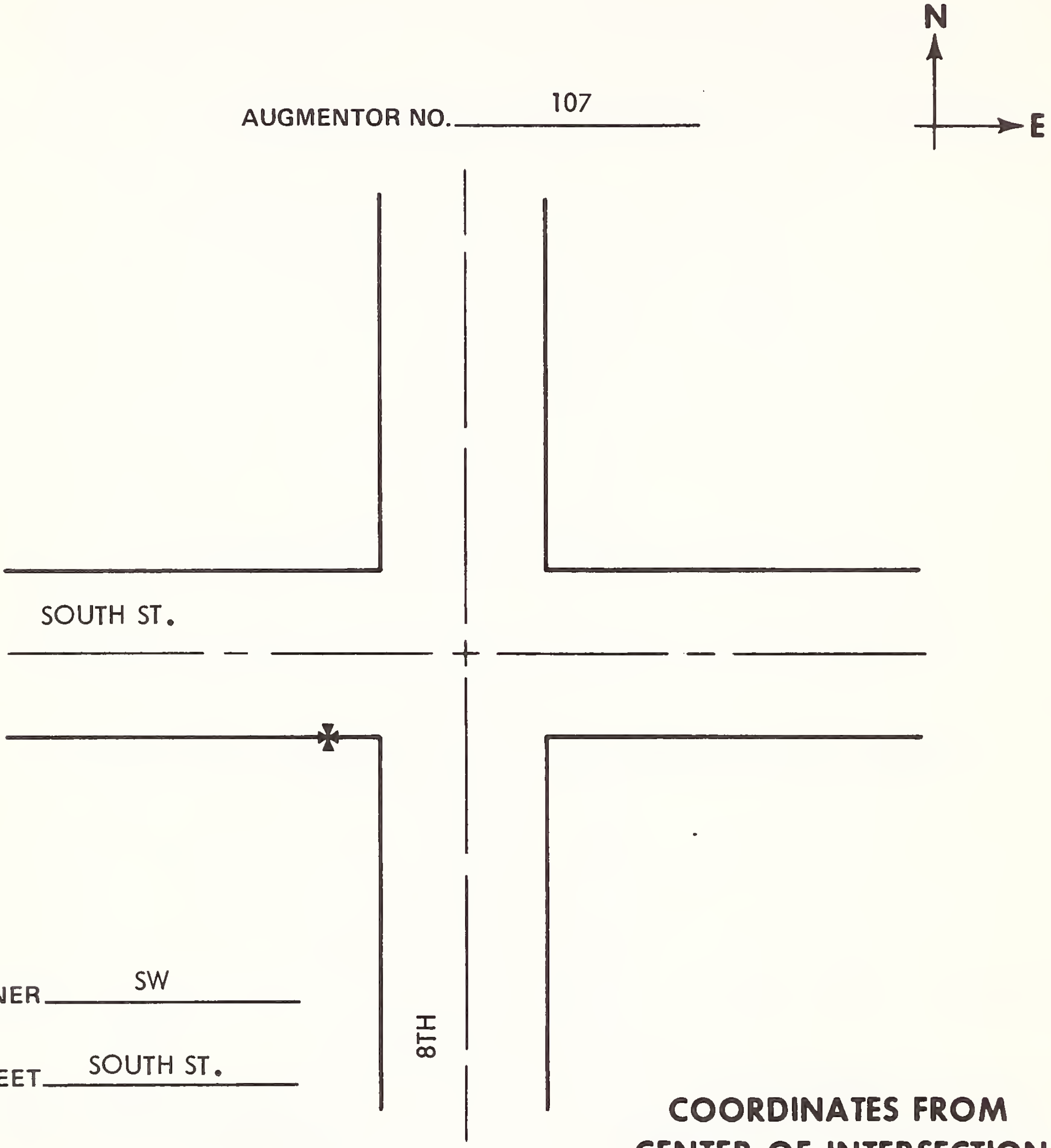
STREET CHESTNUT

**COORDINATES FROM CENTER OF INTERSECTION**

21 FT SOUTH
223 FT WEST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 107



CORNER SW

STREET SOUTH ST.

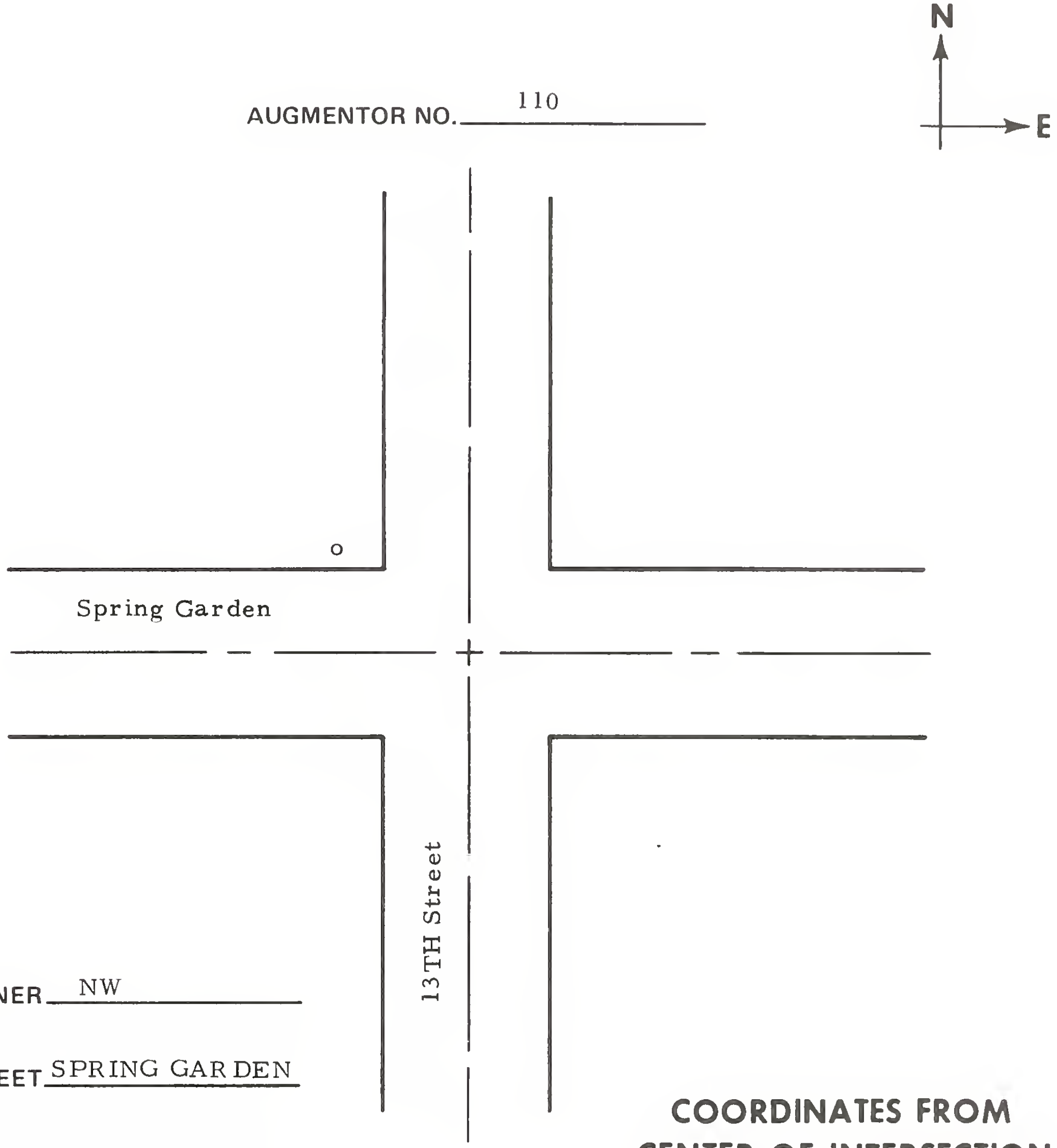
**COORDINATES FROM CENTER OF INTERSECTION**

16 FT SOUTH
24 FT WEST

Revised 1/7/77

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 110



CORNER NW

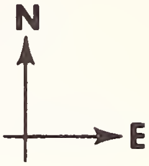
STREET SPRING GARDEN

**COORDINATES FROM CENTER OF INTERSECTION**

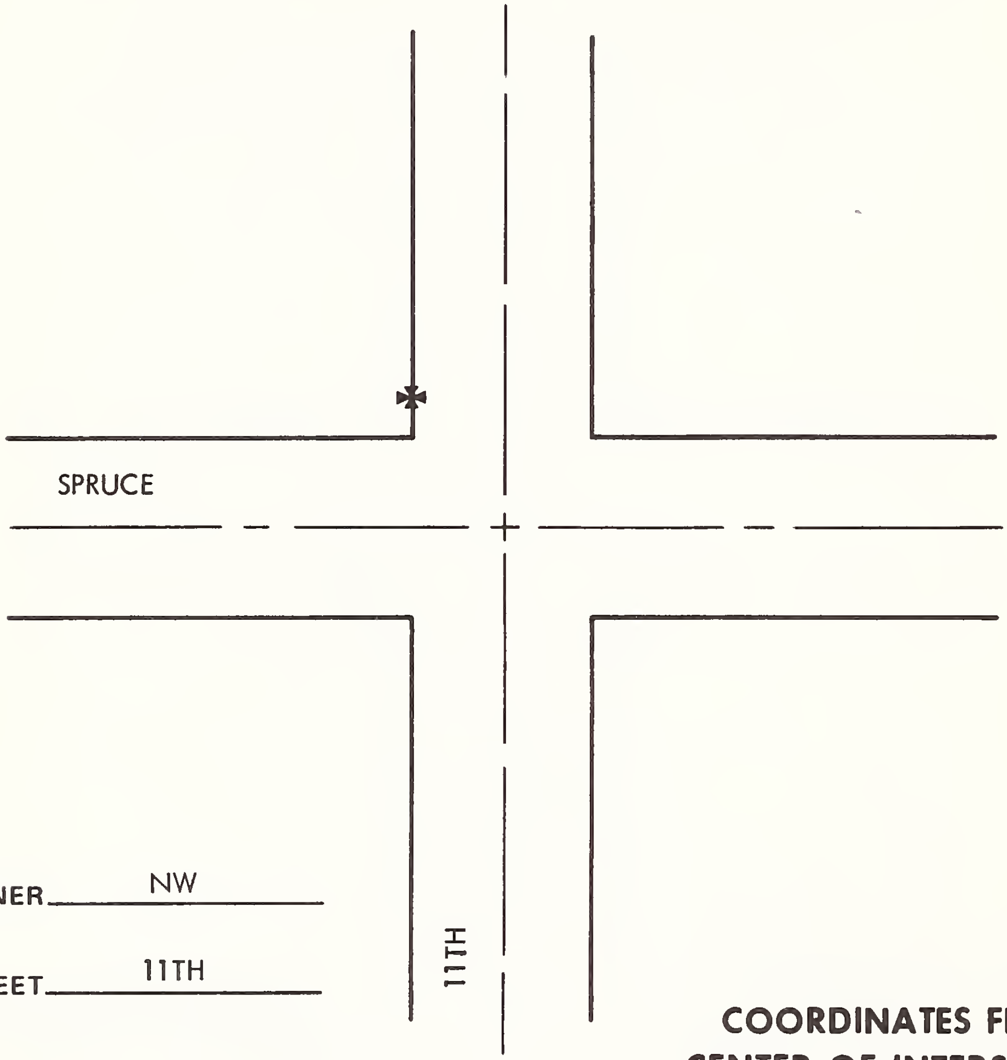
39 FT NORTH

24 FT WEST

# AUGMENTOR LOCATION DESCRIPTION



AUGMENTOR NO. 111



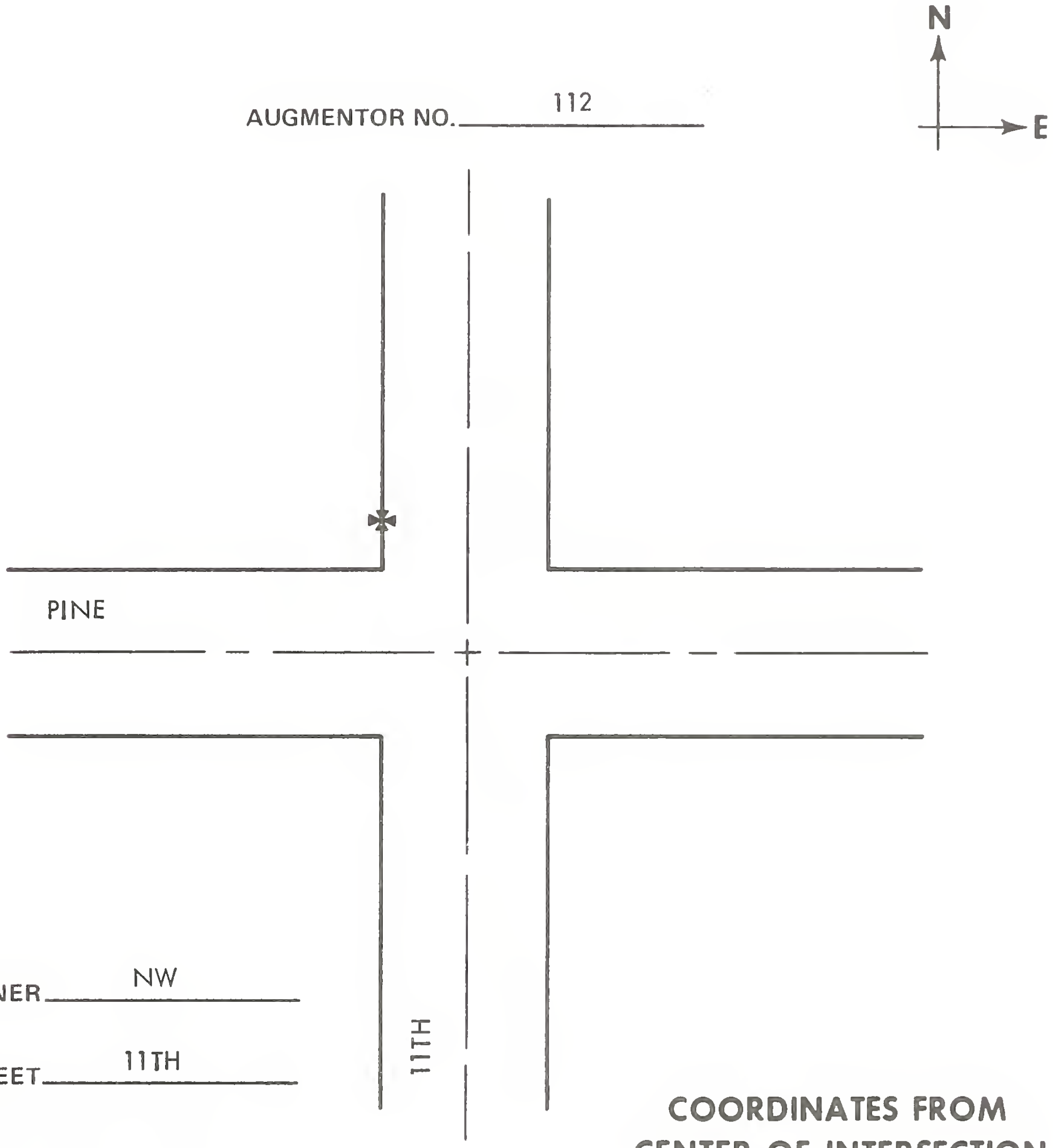
CORNER NW

STREET 11TH

**COORDINATES FROM CENTER OF INTERSECTION**
28 FT NORTH
15 FT WEST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 112



CORNER NW

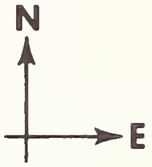
STREET 11TH

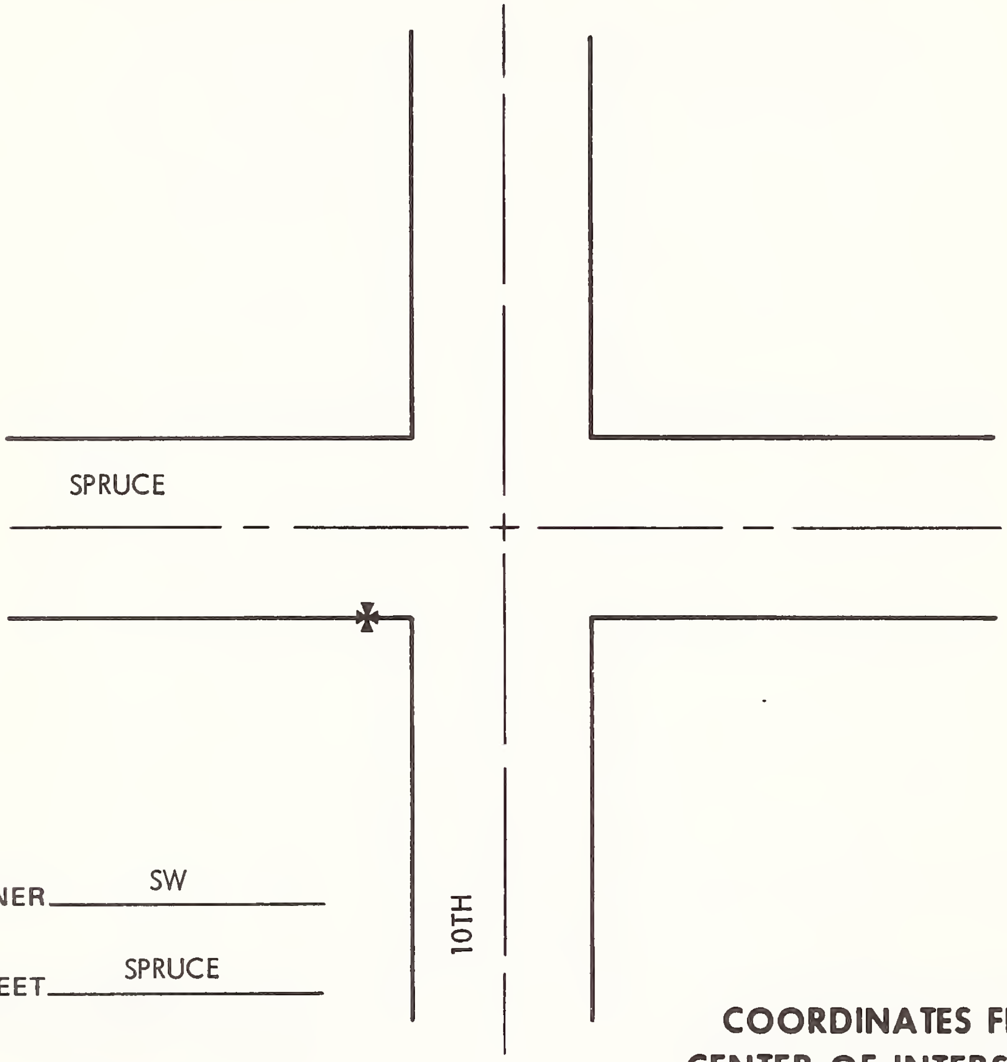
**COORDINATES FROM CENTER OF INTERSECTION**

26 FT NORTH
15 FT WEST

# AUGMENTOR LOCATION DESCRIPTION

AUGMENTOR NO. 113





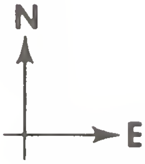
CORNER SW

STREET SPRUCE

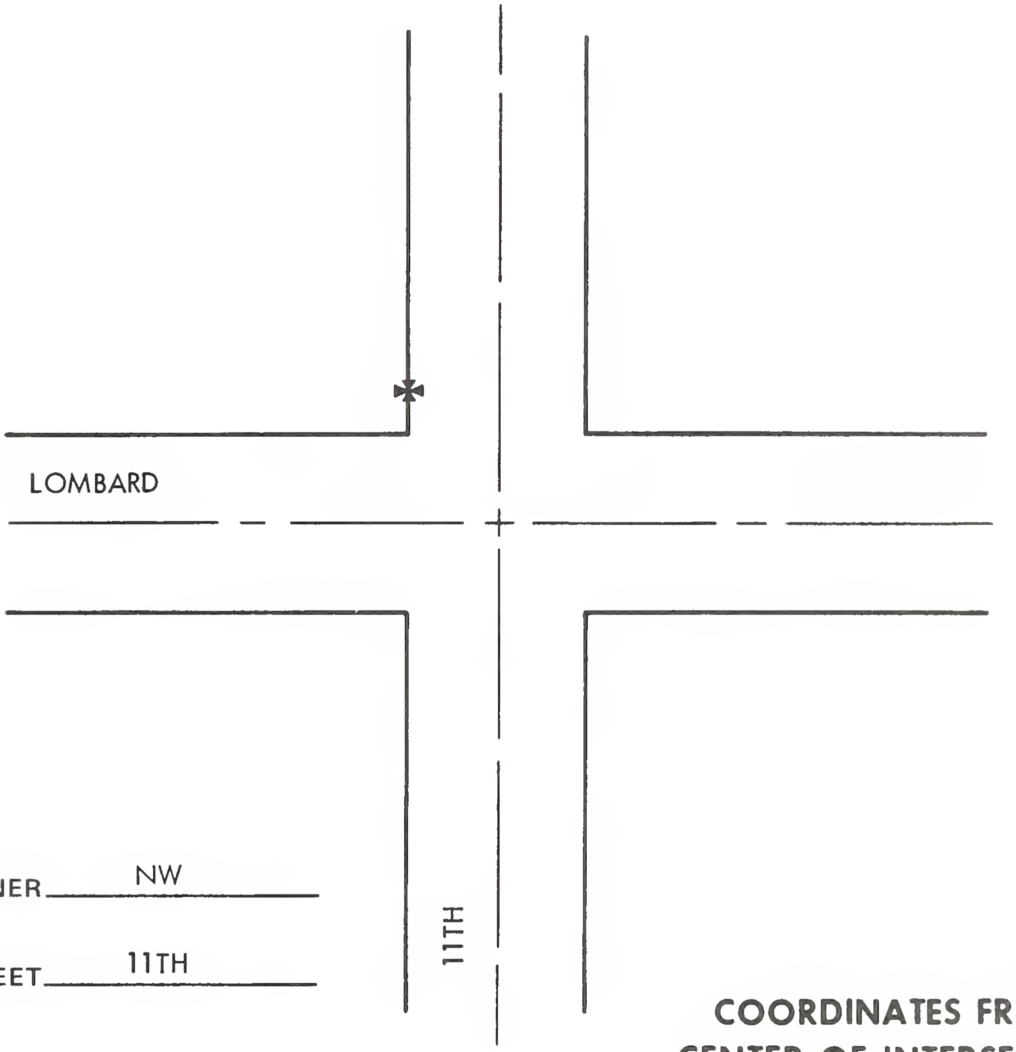
**COORDINATES FROM CENTER OF INTERSECTION**

16 FT SOUTH
23 FT WEST

# AUGMENTOR LOCATION DESCRIPTION



AUGMENTOR NO. 137



CORNER NW

STREET 11TH

**COORDINATES FROM CENTER OF INTERSECTION**

25 FT NORTH
15 FT WEST

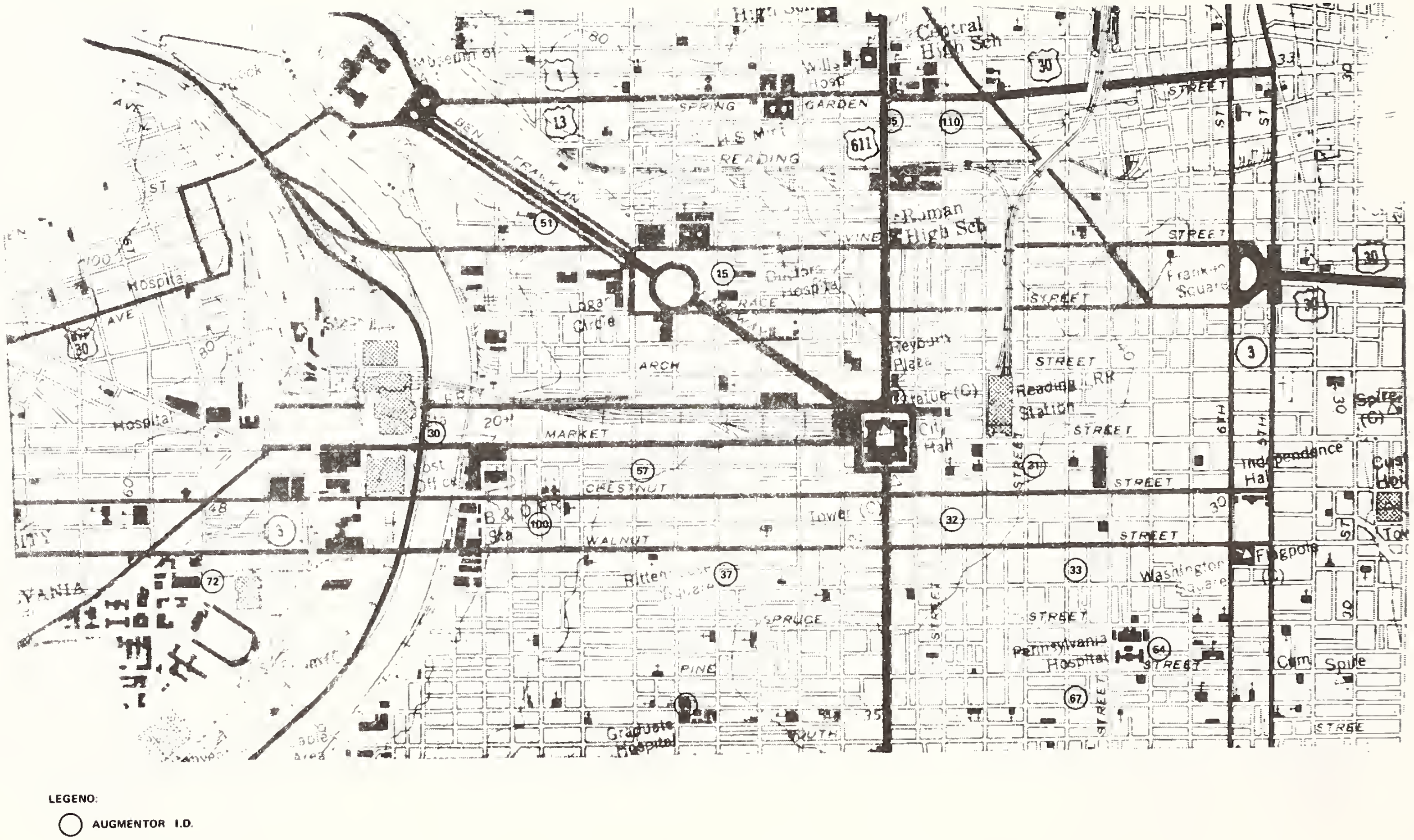


Figure C-1. Fixed Route Augmentor Deployment

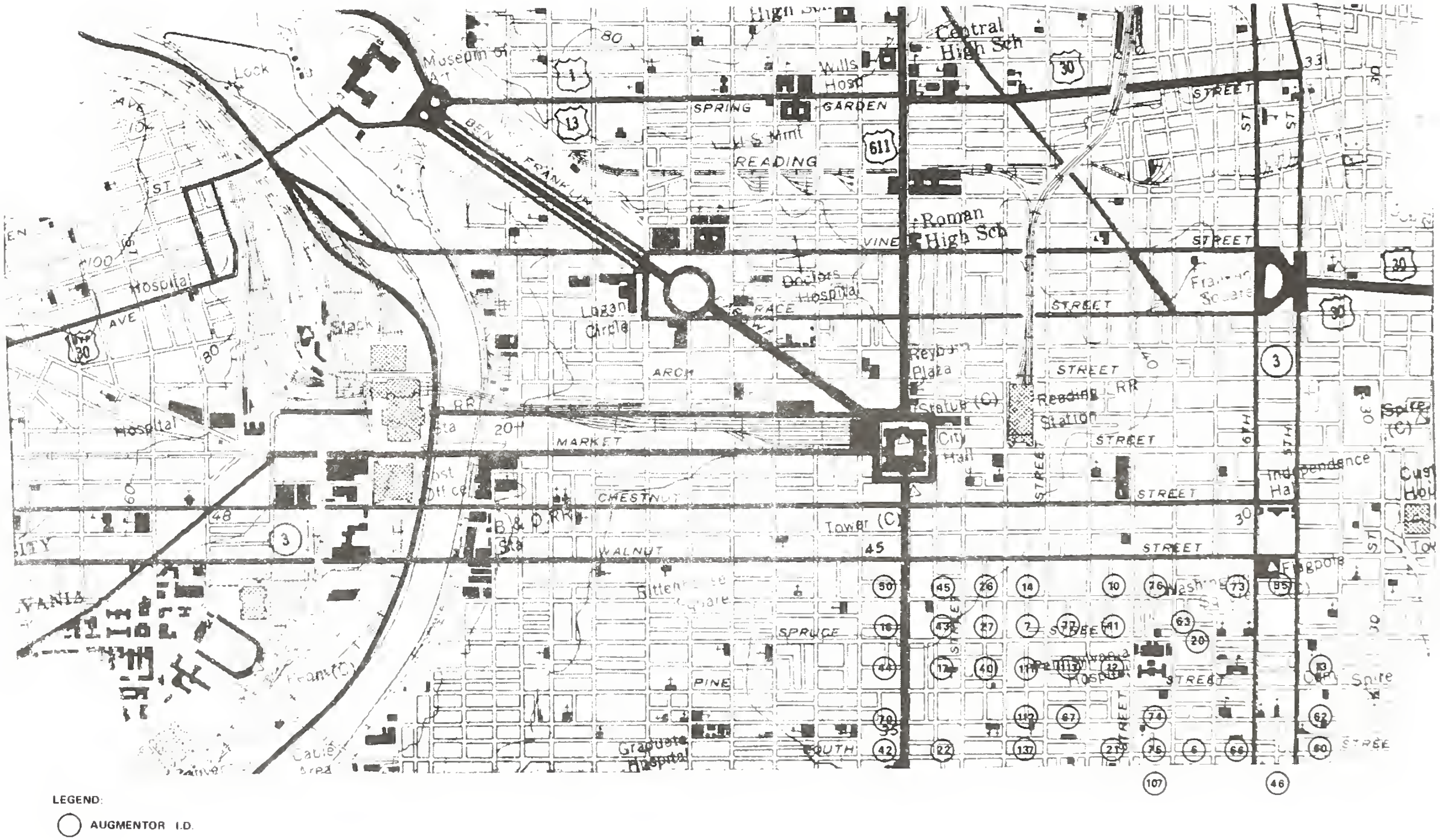
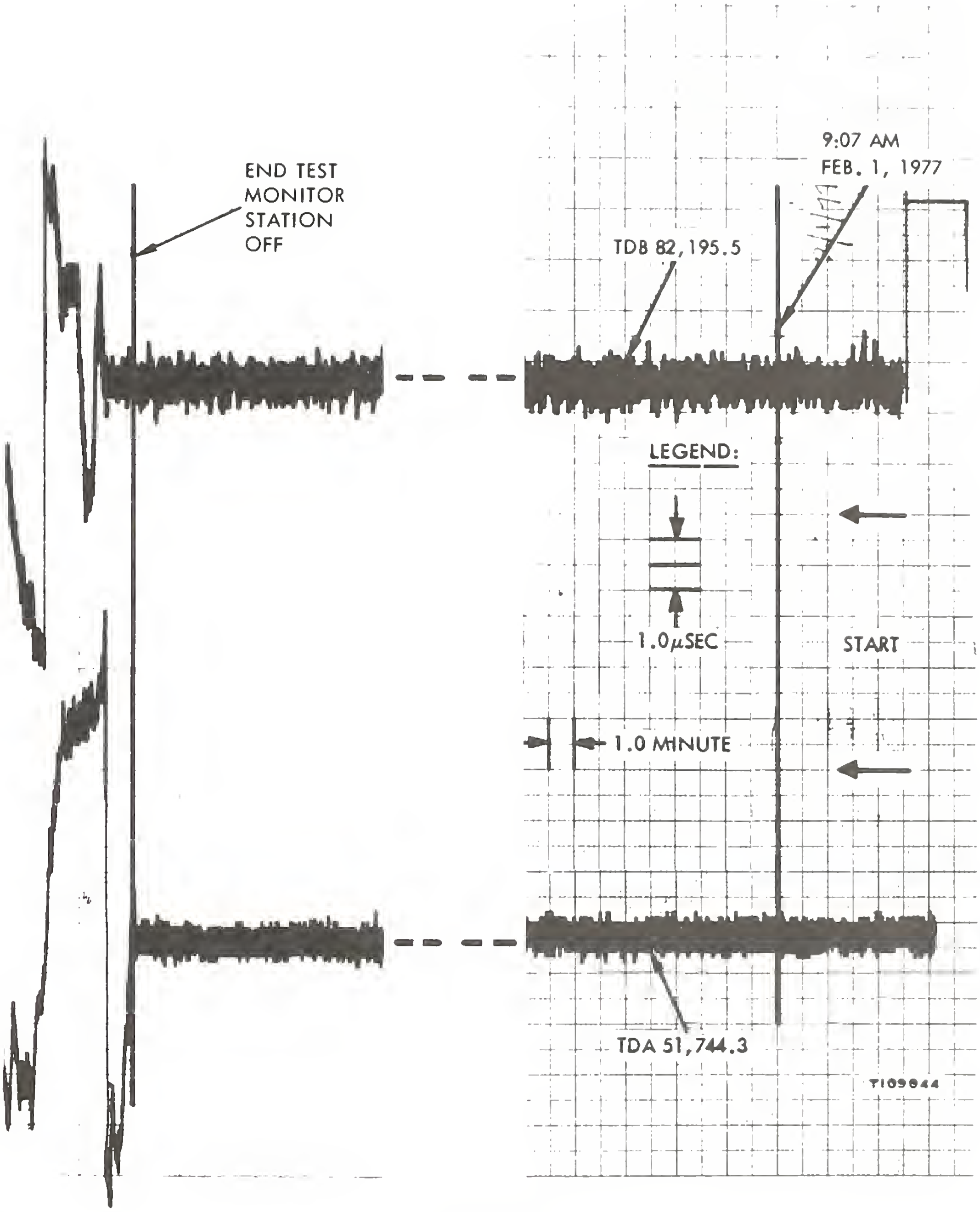


Figure C-2. Random Route Augmentor Deployment

## APPENDIX D - TYPICAL MONITOR STATION STRIP CHART RECORDING

The following stripchart recording is for February 1, 1977 and is a sample of the type of monitor station data recorded during a day's test. The legend and calibrated values are given on the chart for its interpretation.



## APPENDIX E - REPORT OF INVENTIONS

After a diligent review of the work performed under this contract, no new innovation, or discovery was made. However, in the process of implementing such a comprehensive test, there were improvements in that a great deal of practical experience was gained. The severe winter of 1976-77 exposed a deficiency in augmentor circuit design. The test itself could have had additional self-checks to preclude taking data when the AVM system was not operational. The software could have contained a self-analysis routine which would have prevented contaminated data from being melded with good data. All the experience gained is directly applicable to the Phase II program. In summary, a list of technical areas in which valuable experience was gained is given below:

1. The time required to install and adjust wayside devices under difficult conditions should not be underestimated.
2. A self-test or built-in Go/No-Go test capability would be highly desirable.
3. A reliable method of sensing vehicle heading would greatly simplify the random route software.
4. Augmentor range becomes difficult to control at elevations of greater than 15 feet.
5. An odometer 'reasonableness check' will prevent some large errors in the random route software.
6. Time of passage errors can be significantly reduced by integrating the odometer and a door open/closed sensor.
7. In areas of reasonable LORAN signal coverage, the LORAN only location subsystem will exceed the specified accuracy requirement.

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